TEACHER'S MANUAL

Part III.

FOR

PRANG'S COMPLETE COURSE

IN

FORM-STUDY AND DRAWING

BOOKS V. AND VI.

Oct. 1876.

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IN

FORM-STUDY AND DRAWING

Books V. and VI.

BY

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WALTER S. PERRY

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AUTHORS' PREFACE.

THIS course of instruction presents, not Form Study alone, not Drawing alone, but Form Study and Drawing as complementing each other, as together furnishing a means of mental development second to no other study, and indispensable in the education of every child, as leading to a knowledge and appreciation of the beautiful.

FORM STUDY AND DRAWING IN MENTAL DEVELOPMENT.

Recognizing that the development of the mental powers in their natural order, leading to thought, requires not only perception, but also expression, the authors have arranged the work of this Course so that pupils shall first observe and study the forms of models and objects, and shall then express by drawing what they have observed in the forms of the models and objects studied. By the presentation of models of type forms, supplemented by familiar objects, the senses are addressed, the attention is awakened, the powers of observation are incited, the mind is stirred to action, thought ensues. Drawing is then introduced, not simply as a means of training the eye and hand, but as a language by which the pupil not only expresses but impresses his thought. Still further, in the "making" required in the study of the models and objects, the ability to use the hands is trained and encouraged, the creative faculties are developed, and thus manual training, with all its healthful influences, is begun. Pupils going through this Course will not only be led, through the cultivation of their observing powers, to take a lively interest in the forms of objects around them, but will also become conscious of the power of expressing their ideas of such forms by drawing, whether with regard to their facts as

seen in working-drawings, to their appearance as seen in pictures, or to their decoration; at the same time, while the eye has been trained to observe, and the hand to draw, the mind has been constantly unfolding through perception, thought, and expression.

ART EDUCATION.

Still further, it is a distinct aim in this Course to lead pupils to an appreciation and love of the beautiful as found in Nature and as expressed in the hand-work of man. What man has done, what he has created, is Art. It is the belief of the authors that Art Education, or the study and the creation of the beautiful, should be begun with the earliest instruction of children; that while Nature is studied with reference to the facts to be observed, there is yet a truth, a beauty of Nature that transcends all particular or material manifestations; and that this truth or beauty is seen only when these particular manifestations, as embodied in form and color, are observed in their relations to the plan, the harmony, the unity that exist throughout Nature.

DRAWING IN CONNECTION WITH OTHER STUDIES.

It is the hope also of the authors that the work in this Course may lead teachers and pupils to a free use of Drawing as an aid in other studies; and that through the constant connection, both in the Manual and in the Drawing-Books, between type forms and objects familiar to all, teachers and pupils may learn to look upon Drawing, not as subsisting in and for itself alone, but as a very important and ready means of awakening and conveying thought in the other subjects of the school curriculum. Drawing should be as much at the command of every teacher and every pupil as writing and speaking, and should be as freely used.

It is hoped, therefore, that teachers will seek every opportunity to carry the drawing out in broad applications in other studies, and will encourage pupils to use it as a means of expression generally in their school work.

VALUABLE SUGGESTIONS.

The authors desire to acknowledge their obligations for valuable suggestions to Mrs. Hannah J. Carter, Director of the Art Department,

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JANUARY 10, 1893.

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PLAN OF THE SERIES.

THIS series comprises ten Drawing-Books, accompanied by five Manuals, Parts I.–V., which cover the work of the ten books. Each book contains, —

REGULAR DRAWING EXERCISES. OPTIONAL PAGES.

In connection with this work, preliminary practice is to be given by drill exercises, which, while taking but little time, are of the greatest importance in producing freedom of movement and confidence on the part of the pupil.

"Making," in connection with Form-Study and Drawing, is also of great importance. The Prang Pattern Sheets have been prepared to accompany the Drawing-Books of this Course, and are furnished with the books. Upon these sheets patterns are printed for the pupils to cut out and fold to make familiar forms. In these exercises a beginning is made in manual training. The forms thus made are to be used as objects of study and as models for drawing.

NATURE OF THE WORK.

The exercises require, —

DRAWING FROM MODELS AND OBJECTS.
FROM DICTATION.
FROM WELL-CHOSEN COPIES.
FROM MEMORY.
ORIGINAL DESIGN.
MAKING MODELS AND OBJECTS.

Throughout the series the work is based upon the study of models, familiar objects, and natural forms. From the first, pupils learn to draw from real objects and not from copies of objects. As the sense of touch

furnishes one of the readiest means of ascertaining the form of an object, the lessons are so planned as to require handling of the models and objects by the pupils.

The work is strictly educational, — it deals with the mind; through the study of concrete objects thoughts are awakened which the hand and eye are trained to express. The imagination is cultivated, the sense of beauty is developed, and the expression of artistic ideas follows.

The models of type forms used in the first two primary years are studied by way of review, and ideas of form thus presented are expressed by drawing. More thoughtful work is now required in drawing, and the manner of presenting the work is adapted to the ability of the children using each book. Additional models and new objects are taken as the work advances.

CHARACTER OF LINE IN DRAWING.

Particular attention is requested to the character of the lines in the drawing-books. They have the softness and quality of pencil lines. They furnish to pupils models of the lines desired from them, — lines showing freedom of movement, ready handling, and varying expression. Such lines require a soft pencil, — one not harder than an M grade.

VALUE OF COPYING GOOD EXAMPLES.

It is desirable in this work not only that pupils should learn to express their own ideas of form, light and shade, grouping, etc., but that they should learn *good methods* of expression. They should also learn as much as possible of the elements of beauty from the best types of historic ornament. To these ends, exercises in copying good examples are made a part of the work.

GENERAL DIRECTIONS.

In acquiring a knowledge of Form, there are three stages: Perception, Thought, Expression. Observation of Form requires both Perception and Thought. Expression of Form must of necessity be preceded by Observation. These general directions will therefore be classed under the two heads: Observation of Form and Expression of Form.

OBSERVATION OF FORM.

MODELS AND OBJECTS.

The term form will be used in this manual as including three dimensions, while figure or shape will be used as referring to only two dimensions. Both form and shape should be observed first in concrete objects. Hence the exercises in this series of books are based on the use of models and objects. The models are of the simple type forms, and are in both teacher's and pupils' sizes.

For the complete list see description at the end of the book.* The objects chosen are based on type forms, and are such as can be procured with very little trouble.

Every drawing exercise should begin with observation of the models or objects by the pupils. The directions under this head in each exercise are given to indicate to the teacher the manner in which the pupils should be led to observe (that is, to perceive and to think about) the form of models and objects.

Technical terms, which must be given by the teacher, should always follow, *not* precede, the observation of the form or figure to which the term applies.

JUDGMENT OF SIZE AND PROPORTION.

The ability to judge correctly of size and proportion is of great importance, and should be carefully cultivated throughout all form study. An inch (generally expressed 1″) should be made the standard at first, later a foot (generally expressed 1′ 0″) may be introduced, and dimensions may be given in feet and inches. The teacher should in some way intro-

* Where it is practicable, it will be of great advantage to have the pupils well supplied with models, so that each pupil may observe the model for himself through the hand by handling, placing, moving, etc., as well as by the eye.

duce into every exercise, whether from an object or from a copy, questions leading to judgment of definite length in inches, and also to judgment of the proportion of models, objects, and figures, by the consideration of the *relative* length of edges, of diameters, of profiles, and of lines.

DEVELOPMENT OF IMAGINATION.

The value of the imagination in all conditions of life is too often forgotten. The teacher should have in mind constantly the development of the imagination. In studying a model, thought should be led from the model to its mental image, from that to its likeness in common objects, thence on to the possible action and uses of the model. Then in expressing the thought about the model by drawing, the imagination will again come in play and inspire not only the simple drawing of the model, but also the consideration of its various actions and modifications. Such imaginative work should be encouraged, but it should also be controlled.

EXPRESSION OF FORM.

VALUE AND METHOD.

Expression of form is doubly valuable, — on the one hand to the pupil, as a means of completing the study of the form; on the other hand to the teacher, as showing to what degree the pupil has received the idea of a form. There are three ways by which ideas of form can be expressed: by Making, by Drawing, by Language.

MAKING.

Pupils can express their ideas of the form of a model or object most *completely* by making the model or object; therefore, throughout this series, frequent exercises are given in making objects as a part of the regular work. Modeling in clay is an admirable means of expression, and is not difficult as a class exercise. Directions for the management of clay can be found in "The Use of Models," and in the Primary Manuals, Parts I. and II., published by The Prang Educational Company. Teachers should encourage children in making simple objects in clay, paper, cloth, cardboard, wood, etc.

CUTTING.

This exercise has been successfully introduced into many schools. Its object is, that children may learn to observe figures, not lines; that they may learn by doing; to give skill in using something besides a pencil; when colored paper is used, to aid in the study of color; to open new lines of thought; to create interest, — in short, more fully to educate the child. In some of the exercises it is directed that figures or designs cut from paper be pasted upon the page of the Drawing-Book. This gives variety to the work. To carry it out, the teacher has simply to pass about the room with a mucilage-brush and touch each book in one place, near the centre of the space the figure or design is to occupy; the pupil will then lay the design upon the page and press it down. In no case should a design or a piece of paper be pasted all over the back.

DRAWING.

Training in position, pencil-holding, movement, and drawing, as indicated in the following directions, must be systematically pursued.

Freedom of Movement. — The importance of freedom of movement in drawing cannot be overestimated. It produces lightness of touch, quickness in execution, begets confidence in one's ability to draw, and when acquired by a class of pupils, materially lessens the work of the teacher. Experience among thousands of pupils shows conclusively that too much stress cannot be laid on the necessity for the early development of freedom of movement. The ability to sketch rapidly and easily an illustration of a thought awakened in the mind, cannot be attained without it.

A set of drawing-books, finished as draughtsmen would finish them rarely indicates the best teaching. It is of far more importance that the child should have opportunity to work first for freedom of movement rather than for straightness of line.

Position. — The children should sit on the left half of the seat facing the desk. They should sit erect, feet flat on the floor, the eyes never nearer the paper than is necessary for a clear view of the lines. They should not bend forward unnecessarily, and should learn to work at a distance.

Book. — The book should be directly in front of the pupil, pushed back on the desk, the long edges parallel to the long edges of the desk. NEVER TURN THE BOOK. To guard against undue rubbing or offsetting of the lines, and also to protect the page from any moisture of the hand, pupils should use a piece of cotton cloth the size of the page. While neatness in work should always be insisted on, bold freehand work should never be sacrificed for immaculate pages in the books.

Pencil. — The pencil should be of medium grade (The Prang School Pencil M is the proper grade) for all freehand work. It should be sharpened to a round but quite blunt point, and used for drawing only. When the pencil is worn away it should be lengthened by a pencil-holder. Short pencils should not be used.

The pencil should be held lightly *three* or *four inches* from the point, so that it will have the support of the middle finger and be held by the thumb and forefinger. Pencil-holding should be practiced by itself before beginning to draw.

Pencil. — The pencil should always be held at right angles to the line to be drawn when drawing straight lines, and at an angle of about 30° to the paper.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Drawing. — Vertical lines should be drawn from top to bottom; horizontal lines from left to right; oblique lines, as a rule, from top to bottom.

Lines at the left and top should be drawn first, as a rule, though all parallel lines should be drawn in succession when practicable.

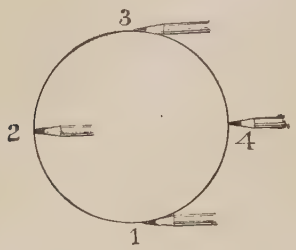


Fig. 5.

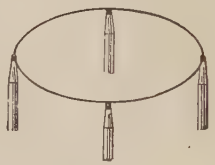


Fig. 6.

Circles and vertical ellipses should be drawn from the lower end of the imaginary vertical diameter, holding the pencil from left to right all the time. In drawing horizontal ellipses the pencil should be held as for a horizontal line. Circles, ellipses, and ovals should be sketched with one sweep of the pencil.

Lines should be drawn continuously, without stopping or retracing.

All curved lines, no matter how short, should be practiced over the printed copy before drawing.

Erasing. — All figures should be sketched with free movement without the use of the eraser. Pupils should erase together as a class, and should not be allowed to use the eraser when lining-in.

Blackboard. — Every opportunity possible for blackboard work should be given to the pupils.

COLOR.

The use of color in the study of form will be found of great value. Color exercises are therefore suggested for each book. A general statement of principles and methods will be found on pages 86, 98–103. A fuller statement of principles and methods, together with a regular course of study in color and specific exercises, with many illustrations, will be found in "Suggestions for Instruction in Color."*

* Published by The Prang Educational Company.

SUGGESTIONS TO TEACHERS

FOR

THE USE OF THE MANUAL.

The text for each exercise is divided into three parts, and each part has its special purpose. For the purpose of clear distinction each part is presented in a particular size of type.

For information with regard to the subject and the special topic of the exercise, the matter in large type should be studied. It will be noted that at the close of this part of the text, the special points to be developed with the class are given.

For suggestive methods of developing in the minds of the pupils the ideas of the exercise, the matter in smaller type headed "Study of Models by Pupils" and "Observation Exercise by Pupils" should be studied.

For definite statements as to the drawing to be done, the matter headed "Practice" and "Direction" should be studied.

It is earnestly hoped that teachers will not look upon the manual text either in its Suggestions or its Directions as something to be rigidly followed, but that they will strive to learn and apply the method and spirit of the work in the instruction of their classes. The attention of teachers is especially called to pages 3, 4, and 36, regarding the method and spirit of this work.

NOTE. — As pupils now receive in the first two years of school good instruction in Form-Study and Drawing, guide points and some illustrative diagrams necessary in the early edition of Drawing-Books I. to VI. are omitted in the later edition. It will be necessary, therefore, for teachers to make the slight adaptation in the instructions in the Manuals for the various exercises which is needed to meet the changed conditions. The drill exercises and practice pages, given in the Manuals as preceding the regular exercises, are to be drawn upon practice paper by pupils using the later edition.

BOOK V.

CONSTRUCTION. *Facts of Form.*	SOLIDS: Sphere, Cube, Cylinder, Square Prism, Cone. OBJECTS: Books, Drinking-Cup, Flower-Pot. MAKING: Cone, Drinking-Cup. CONSTRUCTIVE DESIGN: Vase Forms.
REPRESENTATION. *Appearance of Form.*	CONE, SQUARE PRISM. BOOKS, DRINKING-CUP, FLOWER-POT. NATURAL BRANCH. COMPOSITION: Group of Models and Objects.
DECORATION. *Ornamentation of Form.*	HISTORIC ORNAMENT: Fleur-de-lis. NATURAL GROWTH: Spray or Branch. DECORATIVE DESIGN: Modification of Units, Rosette, Borders.

INTRODUCTION.

The Three Subject Divisions of Form Study and Drawing.

THE study of Form and Drawing includes three distinct yet correlated subjects: —

CONSTRUCTION, the science and art of making diagrams or working drawings, which give the facts of objects, and from which objects may be constructed.

REPRESENTATION, the science and art of delineating or representing objects as they appear to the eye.

DECORATION, the science and art of producing beauty in ornament.

These subjects require the study of objects and examples, and drawing is used as a means of expressing ideas gained by such study.

It frequently happens that instruction in drawing is confined to one or perhaps to two of these subjects.

Pupils are sometimes given only the study of the *facts* of form; such pupils become, through this one-sided study, almost insensible to the *appearance* of form, and remain wholly uncultivated in the recognition and appreciation of beauty in form and ornament.

In other cases, pupils are given only the study of the *appearance* of objects, without any foundational knowledge of the *facts* of form; they are left completely ignorant of the broad uses of drawing in industry, and know nothing of the elements of beauty in ornament.

In still other cases, the instruction in drawing tends wholly to decorative design, leaving out of consideration entirely the study of objects either as to their facts or as to their appearance.

Considerable instruction is sometimes given in the principles of these subjects without making adequate provision for the proper expression of these ideas by the pupils. For want of suitable copies in the three subjects, pupils are left almost wholly to their own devices with regard to suitable rendering by drawing, each subject requiring different treatment.

Any course of drawing, therefore, which does not give well-balanced and closely connected instruction in the three subjects, Construction, Representation, Decoration, which does not also lead to the appreciation of beautiful form in each of the three subjects, and which does not provide suitable examples of "rendering" as well as of historic ornament, can produce only very imperfect and one-sided results.

In Books I. and II. the exercises were planned with special reference to Construction, Representation, and Decoration, although the subjects are not mentioned. In Book III. and succeeding books the exercises are designated as belonging respectively to Construction, Representation, or Decoration, and the exercises in the latter part of each book are devoted to a review of the three subjects. The instruction in the Manuals is arranged accordingly.

Care should be taken to have the nature of these three subjects clearly developed in the minds of the pupils; and frequent opportunity should be taken to recall and impress them. Instruction in the three subjects should be as nearly parallel as possible; it would be found a great disadvantage to pursue one of them for six months at a time to the exclusion of the other two.

Plan of the Manuals.

In preparing the Manual Text for the Drawing-Books of Prang's Complete Course, the endeavor has been to meet all conditions.

In many cases where these books will be used, the regular teachers have been prepared for the work by training and experience, and the pupils have received instruction in Form Study and Drawing according to the Primary Manual called "The Use of Models," and according to the books or method of "The Shorter Course." In many other cases, the regular teachers who are called on to teach these books have had no opportunity to become acquainted with the method or the subject-matter of the work of "The Use of Models," or of "The Shorter Course." Again, the children may not have had previous instruction, or may have received it only to a very limited extent.

The text for these Manuals has therefore been prepared with a view to meeting the needs of both teachers and pupils who have not had previous practice or training. The text under each exercise will consist of two parts, the first part relating to the subject-matter necessary for the information of the teacher; the second part relating to the method of developing these ideas in the minds of the children. The exercises given for "Study of the Model" and for "Observation by Pupils" are given as suggestions. It is expected that teachers will *supplement* and *vary* these exercises by their own skill and tact and through their knowledge of child-nature. If the pupils are beginners in the work, the teacher must be careful to lead the children to such observation as will enable them to discover and recognize the leading characteristics of a form or of a detail before giving the name. If pupils have been already prepared in the work, the earlier exercises in the Drawing-Books may be treated as review exercises by the teacher.

Method.

The method of the teacher should always be to lead the pupils to discover and to express for themselves all that they can about the form to be studied. Thus they will become both receptive and expressive. Therefore do not tell the pupils what they can find out; direct their observations, their thoughts, and their expressions, however, by skilful questions and exercises; remember also that drawing, as well as language, is a means of expression. In the following exercises suggestions are given for developing the work with the class; in order to carry them out well, each pupil should have a model, so that each one can study and discover by touch as well as by sight. Do not give a question that will lead a pupil to repeat what you have said, but give questions that will lead to thought on the part of the pupil. Be careful always to obtain a complete sentence as an answer to any question.

Review of Models previously studied.

The characteristics of the different models are given quite fully below, so that all points, signification and use of terms, etc., may be quite clear in the mind of the teacher before beginning the work of this book. It will be well to have the pupils review previous work in a general way. The review with the pupils can be carried on rapidly, if the teacher is thoroughly prepared.

The models of type forms given for study in Books I. to IV. are the sphere, cube, and cylinder, the hemisphere, square and right-angled triangular prisms, the ellipsoid, ovoid, and equilateral triangular prisms.

The Sphere. — The sphere is chosen as the first model for study, because it is the simplest and the best known of all type forms. It is smooth and pleasant to hold and handle, and always feels the same however you may turn it in your hand. Its outline always appears the same; for however you may turn or place the sphere, the outline is always a circle.

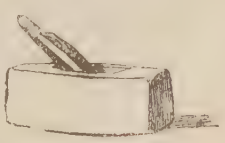
There are many objects like the sphere in general form that are pleasantly familiar to all the pupils. Many fruits — the apple, the orange, the currant, the gooseberry, the peach, the cherry, the grape — as well as the playthings most preferred by children as well as by those of larger growth — marbles, croquet balls, balls for bowling, footballs, tennis balls, base balls — are spherical or spheroidal.

The Cube. — The second model taken is the cube, because it is the most simple type form next to the sphere. It is also the type which in form is the most like and the most unlike the sphere, with which it should be compared. All knowledge is based upon comparison.

The cube is like the sphere in that it measures alike from top to bottom, from left to right, and from back to front. But the cube also differs from the sphere. The sphere is round, and is therefore pleasant to hold; the cube has edges and corners, and therefore, when grasped, will cut and prick the hand. The outside or surface of the sphere is unbroken by an edge; the surface therefore has but one part. The surface of the cube is broken by edges, and thus divided into six parts. A surface or part of a surface unbroken by an edge is called a face; the sphere has one face, the cube has six faces. The shape of the outline of the sphere is like the outline of a circle; the shape of each face of the cube is square. We speak of the *form* of an object as including three dimensions, of *shape* as including but two dimensions. It is necessary that the teacher be very careful in the use of these two words.

The sphere seems the symbol of motion; the cube, on the contrary, represents rest, as it stands so firmly, and does not, like the sphere, move at a very light touch. The faces are all alike, and it can stand on any face. Therefore cubes can be placed side by side or built up so as to match and form a regular structure. Hence we find this form among the building-blocks of children.

As the cube is so compact and so regular, it is a favorite form in many ways. Lumps of sugar, caramels, etc., are like cubes in form; many boxes, baskets, hat-trunks, are like cubes; kitchen stoves frequently have this general form; cubic inkstands and mantel clocks are also found.



The sphere has but one face, and this face is equally round in every direction. It is called a *round* or spheric face. The surface of the cube is divided into six faces, — the *front* face, the *back* face, the *left* face, the *right* face, the *top* face, the *bottom* face. These faces are all perfectly flat, such as would be made by a carpenter's plane. Such faces are called *plane* faces. The name of the kind of face, *plane*, and the name of the carpenter's tool, *plane*, are both taken from the same Latin word *planus*, meaning flat.

In whatever position the sphere is held, but one half of it can be seen. How much of the cube can be seen depends upon its position in relation to the eye. It can be held so that one, two, or three faces may be seen. If held at arm's length, directly opposite the eyes with a face toward you, but one face is visible.

Raise or lower the cube a little, and two faces are visible. If the cube is held opposite the eyes with an edge towards you, two faces are visible; if raised or lowered while in this position, three faces are visible. When the cube is held so that the front face can be seen squarely, the cube is said to be *facing;* otherwise it is said to be *turned.*

The visible portion of the sphere always appears, in outline, round like a circle. The visible faces of the cube do not always appear square. When more than one face is visible, they appear somewhat modified in shape. When placed so that but one face is visible, that face appears square.

The six faces of the cube are all square and equal in size. Its twelve edges are straight and equal in length. When the cube is placed upon a perfectly level surface it has four *upright* or *vertical* faces, and two *level* or *horizontal* faces. The edges forming the sides of the vertical faces are vertical edges; those bounding the horizontal faces are horizontal edges. Hence, when in this position, the cube has four vertical edges and eight horizontal edges. The vertical edges extend directly up and down. The horizontal edges extend from back to front or from left to right. Note this, as the mistake is frequently made of supposing that horizontal edges extend only from left to right. All *level* edges are *horizontal* edges.

The following résumé will bring before the teacher the points of resemblance and difference between the sphere and the cube: —

SPHERE AND CUBE COMPARED.

Type form.	Sphere.	Cube.
Nature.	Ready to move.	Ready to stand.
Outside or surface.	No edges, no corners.	Edges and corners.
Kind of surface.	Round.	Broken by edges, but wholly plane.
Parts of surface, or faces.	One face.	Six faces.
Shape of faces.	In outline like a circle.	Square.
Part visible.	Half of its face.	One, two, or three faces, according to position.

Corners. — The cube has been considered above as a whole, and as to its surface, faces, and edges. A little thought should now be given to its corners. There are three kinds of corners, — solid corners, formed by the meeting of three or more faces (a solid corner formed by the meeting of three faces is called a triface corner); biface corners, formed by the meeting of two faces; and face corners, formed by the meeting of two edges. All of these are found in the cube. The triface and the biface corners may be also either outside or inside corners. The cube has only outside corners. A room or a box has inside corners.

At this time face corners only will be considered. The face of the cube naturally presents itself first, as having been already studied. Any face of the cube is a square. For the purposes of convenient study, cut a square of paper. The square has four equal straight edges and four corners, which are formed by the meeting of the four edges. The corners are all alike. In order to find out most quickly how to describe these corners, it will be necessary to contrast them with other corners. These can readily be produced by folding.

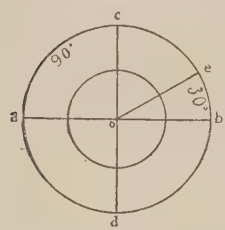
Folding is a kind of manual training. All work in manual training should be done with great care and accuracy. To insure accuracy, folding should always be done on the plane face of some object; never in the air. Lay the paper square on the desk with a corner toward you. Fold the nearest corner over to the furthest corner and crease. There is now one square corner and two different corners. Unfold the square. Turn the square to the right, so that the next corner will be toward you. Fold the nearest corner over to the furthest corner and crease. Unfold. Turn the paper to the right, so that an edge will be toward you. Fold the nearer edge to the further edge and crease. Fold from the corner to the middle, as shown in the illustration. There are now three different kinds of corners, because the edges differ in their relative directions. The edges forming the two left corners meet squarely like the corners of a square, and they are therefore called square corners; the edges forming the upper right corner incline more toward each other and meet more sharply, and therefore it is called a sharp corner; the edges forming the lower right corner incline more away from each other and meet less sharply, and therefore it is called a blunt corner. Many corners of each kind can be found in every school-room. Corners, then, may be classified as *square*, *sharp*, or *blunt*, according to the relative inclination of the edges or faces which make them. This relative inclination is measured by angles.

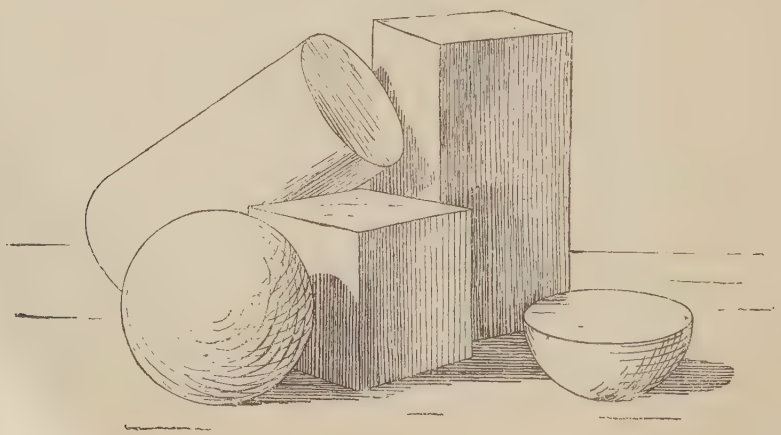
Angles. — An angle is the difference in direction of two or more faces, edges, or lines; it is therefore used as the measure of a corner. The angle made by the edges of a square corner is called a right angle; the angle made by the edges of a sharp corner is called an acute angle; and the angle made by the edges of a blunt corner is called an obtuse angle. In the corners of the folded square you find two right angles, one acute angle, and one obtuse angle. In every corner there is an angle, but there may be angles without corners. A corner is made by the *meeting* of two or more edges or lines. As an angle means simply the difference in direction of faces, edges, or lines, an angle is made whether the edges or lines meet or do not meet. Angles are estimated by the number of degrees of a circle which they contain. Any whole circle has 360 degrees. A

degree always means the three hundred and sixtieth part of the circle, and so designates a less or greater absolute distance, according to the size of the circle. Thus a degree of the distance around the earth is about $69\frac{1}{6}$ miles; while a degree of the distance around an orange, or a pencil, is only the fraction of an inch. But the angle is always the same, no matter what the size of the circle may be.

The number 360 was fixed upon to designate the degrees into which a circle should be divided, because, being the common multiple of so many numbers, but few fractions occur when it is used in making actual calculations; thus, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, etc., will divide 360 without a remainder.

The opening of a right angle is equal to one fourth of any circle. To illustrate: From *o*, as a centre, strike two circles. Draw two straight lines, *a b* and *c d*, perpendicular to each other. The two intersecting straight lines, which make four right angles, will divide each circle into four equal parts. Thus the opening of a right angle is equal to one fourth of a circle, large or small, and equals ninety degrees, indicated thus, 90°. While the size of a right angle is always the same, the size of an acute or an obtuse angle is always indefinite. If we wish to give the exact size of any angle except a right angle, it must be done in degrees. An acute angle is any angle less than 90°. The angle formed by the lines *o e* and *o b*, being one third of a right angle, is an acute angle of 30° (thirty degrees). An obtuse angle is any angle larger than 90°, but less than 180°. The angle formed by the lines *o a* and *o e*, being equal to one right angle and two thirds of another is an angle of 150°.





The Hemisphere. — The hemisphere is taken next. It is readily developed from the sphere by bisecting it. A hemisphere is half of a sphere. It should be studied by comparing it with the sphere and cube. The sphere has one face, the hemisphere has two faces. The hemisphere will stand on either face, will slide on one face, will rock on one face, but it will not roll. One face is similar to the face of the sphere, but because it is not completely round, it is called *rounding*, not round. The other face of the hemisphere is like the faces of the cube, plane. The shape of the plane face of the hemisphere is a circle.

The sphere has no edges; the cube has twelve edges. The hemisphere has one edge. The edges of the cube are straight; the edge of the hemisphere is *curved.*

The form of the hemisphere is naturally more often seen in divided objects than elsewhere, — half fruits of various kinds; but it is also met in many manufactured objects; dishes, bowls, kettles, ladles, are frequently like a hemisphere in general outline; also buttons, caps, lamp-shades. It is important that the children should be led to find the form studied in objects around them, because, on the one hand, the resemblance serves to interest them in the type form itself and to fix it in their minds; and, on the other hand, it tends to make their knowledge of form real and vital, as being a component part of all their surroundings.

The Cylinder. — The cylinder is taken next because it is also a simple and a very familiar form. It is somewhat like the sphere and somewhat like the cube. It is called by Froebel the "mediation" between the sphere and the cube. The sphere will stand and will roll. The cube will stand and will slide. The cylinder will roll and will stand and will slide. Its surface has three parts or faces; two of the faces are plane faces. The other face is curved, as it is round one way and straight one way.

The nature of both the sphere and the cube requires that they shall measure equally from back to front, from left to right, from top to bottom. The cylinder, however, is not so restricted. Its height or length may be of any proportion to its width. Thus a wire, an unsharpened lead-pencil, a rolling-pin, a street-roller, a collar-box, a coin, are all cylinders, although of such different proportions. They all have three faces, — two plane, one curved. As the form of the cylinder allows of so great a variety of proportions, a simple yet pleasing proportion was chosen for the cylinder in the Prang Sets of models. This element of proportion (which is, in art, the pleasing relation of unequal parts) adds much to the beauty of the cylinder. Beauty should always be considered in the preparation or selection of materials for Form Study.

In Nature, the trunks of trees, the limbs between the offshoot of one branch and that of another, the branches between the twigs, the twigs between the nodes, are somewhat like a cylinder. A node is the point on a stem where a leaf starts. The cylinder is a favorite form in many ways. Handles are many times cylindric, as a cylinder can be so comfortably grasped and held; from the handle of a baby's rattle to the handle of a crowbar, the cylinder occurs. Penholders and pencils are like cylinders. A hollow cylinder is also a favorite form for many receptacles. Music-rolls, travelling-rolls, needle-books, etc., are found in the form of a cylinder. Cans of various sorts are cylindric. Napkin-rings, umbrella-stands, pails, cups, etc., are like a cylinder. Boilers, gasometers, cisterns, are like a cylinder. The form of all binding material is generally of the form of a cylinder, as wire, string, cord, rope. Conduits are generally of the form of a cylinder, as water, gas, and steam pipes.

A Prism. — A prism is a solid having two equal faces parallel to each other, called bases, including between them as many square or oblong faces as the bases have sides. A prism is named from the shape of the two equal faces or bases. These faces are called bases because the prism rests upon one of them when in its normal or vertical position.

The Square Prism. — The square prism is a solid having six plane faces, two of them being equal square faces parallel to each other; its four other faces being equal and its opposite faces parallel. It is called a square prism from its two equal square faces or bases. When the term square prism is used, it is generally taken to mean a solid which is higher than wide; but a cube (in which the height equals the width) is also a square prism; and a square plinth (in which the height is less than the width) is a square prism. All these have two equal square faces parallel to each other and four other equal faces, the opposite faces being parallel.

The square prism is a very regular model. Like the cylinder, it has always two of its dimensions equal, and the third variable. Place the cylinder and the square prism upright. You will see that the cylinder measures the same from back to front as from left to right. It is the same with the square prism.

The proportions of the sphere, cube, and hemisphere can never vary. The sphere and cube must each, by their form-nature, have their three dimensions equal. The hemisphere must always be in the proportion of 1 to 2. All type forms except the sphere, cube, and hemisphere may vary in proportion and yet keep their form characteristics. In planning the Prang models, it was thought best to have, as far as possible, a simple, pleasing, definite proportion between width and height throughout the models of type forms. The proportion deter-

mined for use was 1 to 2. The models of the cylinder and the square prism are therefore in the proportion of 1 to 2. It would be a mistake, however, to conclude that cylinders and square prisms must be always in this proportion.

But while the two models agree in having two of their dimensions equal and the third variable, they differ in the number and shape of faces or of parts of faces visible. The cylinder has three faces, — two plane and one curved; the square prism has six faces, — two square and four oblong.

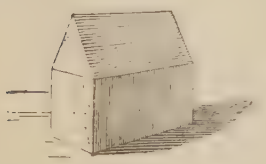
The stems of some plants are somewhat like square prisms, but the form of a square prism is not common in Nature. Boxes and trunks are generally like a square prism, as its form is so well adapted to packing. The square prism is the form often chosen for horizontal and vertical supports, as the long plane face affords so good a resting-place for other timbers. Cars, omnibuses, and other vehicles frequently have the form of a square prism.

Right-Angled Triangular Prism. — If the vertical square prism is bisected vertically through the diagonal of its top face, two new prisms result, having right-angled triangular bases, see page 22, Fig. 6; they are therefore called right-angled triangular prisms. This name is long and it may be abbreviated to right-angled tri. prism, but it will not do to call it a right tri. prism. A right prism is any prism that has its axis perpendicular to its bases, Fig. 1; it is called a right tri. prism to distinguish it from a prism having its axis oblique to its bases, Fig. 2. The name right tri. prism means, therefore, simply a triangular prism whose axis is perpendicular to its bases, and it does not imply that its bases are right-angled triangles. The prisms studied in these early exercises are all right prisms. An application of the right-angled triangular prism is frequently observed in roofs.

Fig. 1.

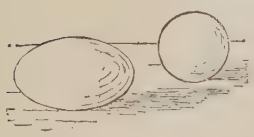
Fig. 2.

Equilateral Triangular Prism. — There are also other triangular prisms, named according to their bases. The equilateral triangular prism (equi. tri. prism) is named from its bases, which are equilateral triangles. It has five faces, two triangular and three oblong faces. It is here illustrated, placed on the square prism, with which it should be compared.



The form of the equilateral triangular prism, as well as of the isosceles and right-angled triangular prisms, is found among prisms used for the decomposition of light. It is also found in shelters of various kinds.

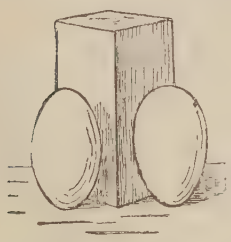
The Ellipsoid. This is a model somewhat like the sphere, and it should be studied by contrast with the sphere. They are both pleasant to hold. The surface of each is unbroken by an edge, therefore each solid has but one face. The sphere, however, measures alike from top to bottom, from left to right, and from back to front; the ellipsoid held vertically measures the same from left to right and from back to front, but its height is greater than its width.



The sphere is beautiful in its perfect roundness, but in the ellipsoid we find another element, that of proportion. It is longer than it is wide, consequently its surface differs from that of a sphere. The surface of a sphere is round; that of an ellipsoid is called rounding. Try to roll the ellipsoid; you will find that while it will roll easily back and forth if placed horizontally, if you wish to change its course, you must turn it a little. If you place it in a vertical position on the table, and give it a little impetus, it will roll spasmodically.

We find that many things which are pleasant to eat and pleasant to see have this form, — fruits, as lemons, plums, barberries, gooseberries, Malaga grapes, etc.; the garden seed-holders, as cucumbers, watermelons, muskmelons, etc.; nuts, as pecan nuts, English walnuts, butternuts, etc. The cocoons of insects have this form.

The Ovoid. — This form must be studied in contrast with the ellipsoid. The sphere is pleasant to hold in the hand, but pleasanter still to roll in any direction; the ellipsoid can be grasped with pleasure by the hand, and it rolls back and forth, but a little unsteadily; but the ovoid nestles with comfort in the hand as if recognizing its home, and in rolling, it describes a circle as if completing the circuit of life.



The surface of the ovoid is unbroken by an edge; therefore, like the sphere and the ellipsoid, it has but one face, only half of which can be seen at one time. These three models differ, however, as to their axes; the sphere has any number of axes, the ellipsoid (vertical) has one vertical axis and any number of horizontal axes; the ovoid has but one axis.

But the element of proportion seen in the ellipsoid assumes a higher character in the ovoid. Hold the ellipsoid in a vertical position, the proportion lies between the height and the width. In the ovoid, the proportion lies not only between the height and the width but also between the parts above and below the greatest width. The ovoid, when in its normal position, has its axis vertical, and

its greatest width nearer the upper than the lower end of the axis. The upper part of the ovoid resembles a sphere and the lower part resembles the ellipsoid.

The ovoid is found in a great number of natural forms, — in buds of flowers, in hops; in fruit, as plums, pears, strawberries, figs, pineapples (and these you notice are of most delicious flavor); in vegetables, as egg-plant; in nuts, as acorns, hazelnuts, etc.; in seed-vessels, as the poppy, the rose-hip, etc.; in the bodies of animals; in the bodies of birds as well as in their eggs; in the bodies of insects; in the human head. In manufactured objects, there are jars and vases of infinite variety based on the ovoid.

Plane Figures. — The plane figures derived from the study of these solids (see page 4) are the circle, semicircle, square, oblong, right-angled triangle, equilateral triangle, ellipse, oval. The shapes of these figures are found frequently in the faces of objects.

In the study of these figures as to shape and proportion, many details, such as diameter, diagonal, axis of symmetry, altitude, are discovered.

During this study, other figures, as different kinds of triangles, also rhombus, rhomboid, trapezium, trapezoid, pentagon, hexagon, may be brought out.

The glossary, at the end of this Manual, gives illustrations and descriptions of all these figures.

Drill Exercises.

Practice Paper. — It is desirable that pupils should have some practice in movement and drawing before beginning work in the Drawing-Book. For this purpose, use sheets of manila practice paper, six by nine inches.* This paper will be found useful for practice previous to many of the exercises throughout the Drawing-Book, as well as for folding. The sheets should be used on both sides for drawing. Provision should be made for from twenty-five to thirty sheets for each pupil for use with one Drawing-Book.

Drill Exercises Necessary. — In order to draw well, two things are necessary, — a knowledge of the thing to be drawn, and skill of hand to draw. Study, then, not only the object to be drawn, but endeavor also to attain skill of hand through repeated practice.

It is not enough that the mind wills the hand; the muscles must be trained to obey. Hence throughout this series frequent drill exercises are given to afford practice for proper pencil-holding, free movement, and ready drawing. The

* The paper is put up in packages of one hundred sheets, and may be obtained of booksellers and of The Prang Educational Company.

teacher should seek to become ready in drawing, and should carry out the exercises given to the pupils.

The first exercises chosen are simply in movement directly *from top to bottom*, *from left to right*, and also *round and round*. The first steps preparatory to these exercises are very simple; but they are essential to success, and should therefore be practiced with great faithfulness.

Books and Pencils. — The name of the owner should be carefully written upon each Drawing-Book before the time of the lesson. The books should be placed in piles arranged according to the rows of pupils, to be ready for distribution when desired. The pencils should be sharpened to a blunt point, so that a soft line may be obtained. If the pencils have sharp points, they will make thin, hard, wiry lines, instead of the broader, soft, gray lines, which are so much more pleasing.

Pencil-holding. — Before beginning work on the paper, give practice in pencil-holding. Let a monitor for each row place a pencil in the groove of each desk in the row, taking care to have each pencil point toward the left. Then give exercises as follows in taking up the pencil and in holding it properly: Hold up the left hand; take your pencil near the point with the thumb and first two fingers of the left hand; place the pencil between the thumb and first two fingers of the right hand, letting these grasp the pencil lightly near the middle. Thus the pencil will be quickly placed in the hand, and long pencil-holding will be insured. It will be well to have pupils lay down and take up their pencils together three or four times, so that the manner of doing may be well understood.

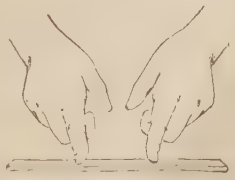
Movement for Straight Lines. — Free work both in movement and in drawing is of the greatest importance; for drawing, to be valuable, must be free and ready.

Give practice in movement with the pencil from back to front on the desk, and see that *each pupil* holds the pencil at an angle of about 30° to the desk, and pointing directly to the left (see Fig. 1, page xiii); the same for movement from left to right, the pencil at an angle of about 30°, and pointing toward the back of the desk (see Fig. 2, page xiii); and from corner to corner (see Figs. 3 and 4, page xiii). To keep the children together for movement, count as follows: One, back; two, back; three, back. Endeavor to make the whole movement continuous, unbroken; therefore count in even time.

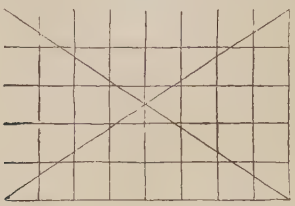
The illustrations on page xiv show drawing at the board, with the crayon held properly with relation to the line to be drawn.

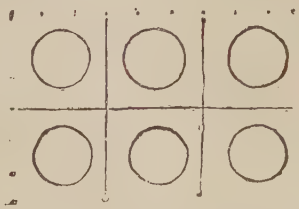
Practice. — The practice paper may now be distributed, and the paper placed in front of the pupil, with long edges from left to right. Each pupil may place a point that shall be an inch from the upper edge and an inch from the left edge. Beginning at this point, lines an inch apart, and ending an inch from the lower edge, may be drawn down the paper at the count of the teacher, movement being practiced first. When counting for movement for straight lines and drawing combined, count as follows: One, back; two, back; three, ready; draw. The movement may be made as many times as seems desirable, — generally not less than two nor more than five times before drawing, — but the word for the last movement back should be *ready*, that pupils may be prepared to draw. If desired by the teacher, the drawing may be continuous down and up, or forward and back several times. Beginning at the first point, lines an inch apart, and ending an inch from the right edge of the paper, may be drawn across the paper at the count of the teacher, movement being practiced first. Beginning at the first point again, a line may be drawn in a similar way to the lower right corner; and beginning at the upper right corner, a line may be drawn to the lower left corner.

Movement for Circles. — Give directions for holding the pencil for movement round and round with the pencil pointing toward the left (as if for drawing a vertical line), and for practicing the movement on the desk (see Fig. 5, page xiv). The pencil must be held the same throughout the movement. Count, One, two, three, four, etc., counting but *one* for each circular movement. For the last complete movement before drawing, say *ready*. The counting will then be, One, two, three, ready, draw. After practicing the movement on the desk, the paper may be taken; pupils may bisect the left edge and trisect the upper edge, using the fingers as shown in the illustration, or a finger and a pencil. From the points of trisection, verticals may be drawn down the paper, and from the point



of bisection, a horizontal may be drawn across the paper at the count of the teacher. In each space a circle may be drawn at the count of the teacher, special attention being given to pencil-holding and to free movement. If desired by the teacher, the drawing may be continued round and round several times. Illustrations of these two exercises are given below.





Quality of Line. — It is desirable that the line in this work should be, as a rule, broad, soft, and gray, instead of thin, wiry, and black. The texture should be open and transparent. To secure this, the line should be made with light pressure, using rather a soft pencil. There will then be little spaces between the particles of lead which make the line, giving it openness and transparency.

Length of Exercise. — As the purpose of the drill exercises is to give practice in free movement and ready drawing, it would be a great mistake to make these exercises long. No drill exercise should occupy ten minutes, and the best results in the end will be reached if not more than five minutes are spent. The children will soon become anxious to produce good work in the shortest space of time.

Order of Class Work.

I. Form Study by Pupils.
II. Position of Book, of Class.
III. Pencil-Holding.
IV. Drawing of Construction Lines. — Class Exercise.
V. Drawing Outlines. Class or Individual Exercise.
VI. Use of Eraser.
VII. Finishing the Drawing.

Details of Work.

I. In Construction and in Representation, teachers lead pupils to study models or objects and examples; in Decoration, to study arrangement and examples of ornament.

II. Pupils place their books with long edges parallel to the front of the desk, but pushed well back; they take pencils and positions for drawing the construction lines, sitting upright.

III. They hold pencils long, and place them at right angles to the line to be drawn.

IV. They draw all construction lines continuously, without stopping, and at the word of the teacher; one line being drawn, all lines parallel to that line are next drawn. Light work. No testing, no erasing.

V. The outlines desired are then drawn, either as a class exercise or each pupil moving and drawing by himself and correcting with his pencil.

VI. Pencils are then placed on the desk, the eraser is taken for the first time and used in erasing superfluous and incorrect lines.

VII. The eraser having been used, it is put aside and pencils again taken to finish the work.

There are some exercises in which all these details will not be found applicable, but they show the general plan to be pursued.

CHAPTER I.

CONSTRUCTION;

Or, Drawing as Applied in Conveying Ideas of the Facts of Objects.

Of the three subjects, **Construction, Representation,** and **Decoration,** *Construction* is the one upon which the others should be built. It deals with the facts of form, and shows the use which is made of the drawing of these facts, in the world of industry. Its importance, both educationally and practically, cannot be too strongly emphasized.

Construction is the science and art of making drawings which give the facts of objects and from which objects may be constructed. These are called working-drawings, and are necessary to guide the workman in nearly every branch of manufacture.

In Books I. and II. the facts of form of models and objects, as shown in various views, are studied as a means of gaining a complete knowledge of type forms and as leading to observation of form in general. The study of the facts of form is continued in the succeeding books; and the study is further developed, so that pupils will be able to read working-drawings and to make them from objects, and also to make working-drawings of objects not yet constructed. Constructive design receives attention, and beauty of form is constantly considered.

A Working-Drawing.—A working-drawing is a drawing which gives all the facts of form, size, and structure of an object. Its purpose is to show a workman with accuracy all the facts of an object which is to be made. This object may be one already made or it may exist only in the brain of the inventor or designer.

A working-drawing is, therefore, composed of as many different geometric views of an object as are necessary to the complete understanding of the object.

A geometric view shows an object under the simplest possible conditions; that is, as seen with but two dimensions. For such a view, the object is supposed to be placed not only directly in front of the eye, but as though each individual part was directly in front of the eye.

The different views required in a working-drawing are named from the part represented in the view; thus the front view represents the view obtained by looking directly

at the front of the object; the top view represents the view obtained by looking directly down upon the object; and so on with the other views.

It has been agreed by long custom to represent certain things in working-drawings by certain kinds of lines; agreements of this sort have come to be known as "conventions." The "conventions" of construction to be noted at this time are few. The various kinds of lines used are centre lines, working lines, visible lines, invisible lines.

In lead-pencil drawing, the centre line — that is, the line for placing the views — is usually made a short-and-long-dash line - —— - —— - ——, the long dashes being made longer than those for "invisible lines." Working lines, by means of which distances are transferred from one view to another, are frequently made short-dash lines, but they may be made light lines. Working lines, however, are used only in elementary practice.

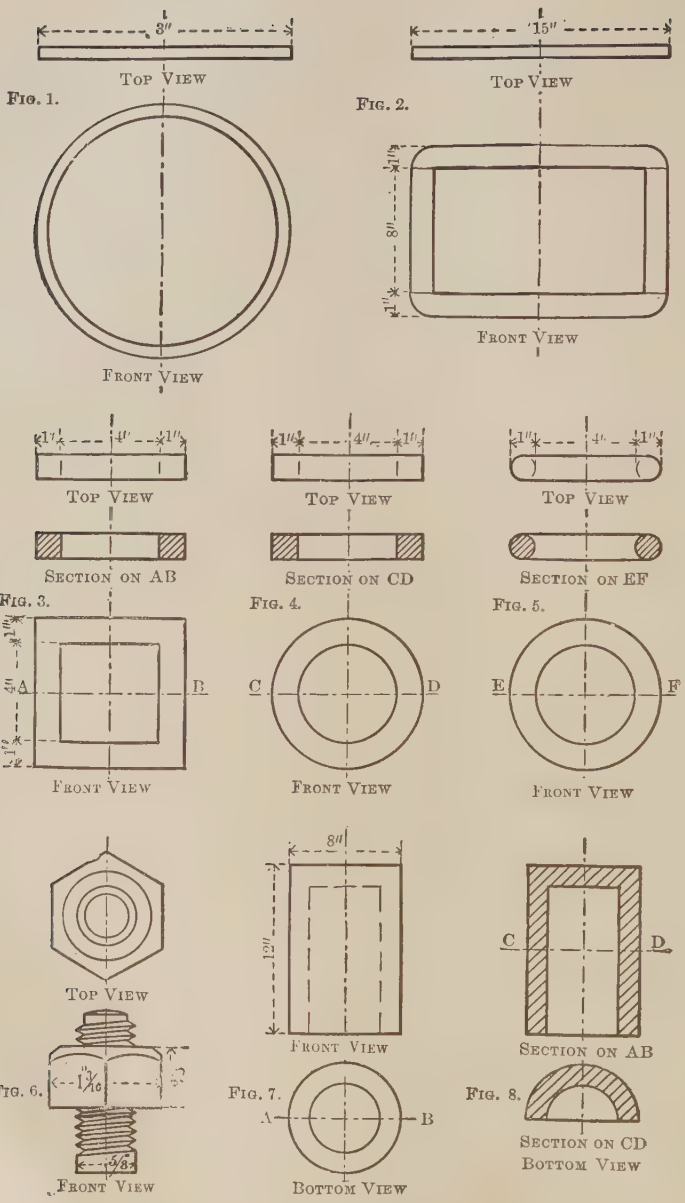
All visible edges and outlines — that is, edges and outlines which are actually seen in the view to be drawn — are represented by clear, full lines, called "visible lines," perfectly even and uniform, not too strong nor yet too fine. "Invisible lines" representing edges or outlines which are known to exist in the object, but which are hidden in the particular view which is being drawn, are always made long-dash lines — — — — —, and should be of the same strength as the full lines. By means of these conventions the purpose of these various lines is seen at a glance.

Dimension lines figured show the size of the object. They are limited by arrow heads; they may be either short-dash lines as illustrated on page 20, or they may be long fine lines <———— 0′ 6″ ————> broken by the insertion of the figuring necessary to show the size.

It is necessary to multiply the views as the details of the object increase, and as the construction becomes more complicated; but it is not often in simple objects that more than three outside views are required. Yet there are six outside views of any rectangular object: top view; bottom view; front view, sometimes called upright view or face view; back view; left-side, or end view; right-side, or end view. In addition to these, there may be as many sectional views as are required for a clear understanding of the internal construction and details. A sectional view is a representation of an object, which gives two dimensions and details of the object, as seen when it is cut through horizontally or vertically or obliquely, thus showing the construction of the interior.

Illustrations of working-drawings of simple objects will be found on page 20. Fig. 1 shows two views of a hoop; Fig. 2, two views of a slate; Fig. 3, three views of a square frame, square in section; Fig. 4, three views of a circular frame, square in section; Fig. 5, three views of a circular frame, circular in section; Fig. 6, two views of a screw; Fig. 7, four views of a hollow cylinder, closed at the upper end.

It will be seen that in Figs. 3, 4, 5, and 7 sectional views are necessary to show the facts of form of the objects.


3"
Top View
Fig. 1.
Front View
15"
Top View
Fig. 2.
1½"
8"
1½"
Front View
1½"
4"
1½"
Top View
Section on AB
1½"
4"
1½"
Top View
Section on CD
1½"
4"
1½"
Top View
Section on EF
Fig. 3.
1½"
4"
A
B
1½"
Front View
Fig. 4.
C
D
Front View
Fig. 5.
E
F
Front View
Top View
Fig. 6.
1 1/16"
5/8"
Front View
8"
12"
Front View
Fig. 7.
A
B
Bottom View
C
D
Section on AB
Fig. 8.
Section on CD
Bottom View

The "conventions" mentioned above — centre lines, visible lines, invisible lines — are illustrated in these working-drawings. It will be noticed that these drawings give the facts of size as well as of form. Working lines are illustrated on page 75.

Dimensions. — Clear ideas of dimension are necessary in the subject of construction.

Dimension is extent in any one direction.

Dimension in only one direction, as of a line, is known as length.

When there are two dimensions, as of any surface, the two dimensions are called length and breadth.

When there are three dimensions, as of a solid, the longest dimension is known as length, the next is known as breadth, and the shortest is known as thickness. Thickness, however, always expresses solidity, and is never used to express the third dimension of a hollow object.

The terms just spoken of are applied to solids and objects without reference to position.

Let a solid now be considered with regard to both dimension and position. It has three dimensions, as before, but the dimensions now have definite direction, — it has one vertical dimension and two horizontal dimensions. The vertical dimension is known as height; and the horizontal dimensions are designated by width: 1, width from left to right; 2, width from back to front.

When the vertical dimension is less than the shorter of the horizontal dimensions, it is sometimes known as thickness. It is better, however, as a general rule, to adhere to the terms height, width from left to right, width from back to front, in speaking of objects placed in a definite position.

The idea of dimension (extent in any one direction) should be developed in the pupils' minds before the word "dimension" is given, and before the different designations of dimension are given.

Pupils may be called on to measure the length of certain lines in the room, whether vertical, horizontal, or oblique. Then they may measure faces, — so many inches one way, so many inches the other way. Then they may measure solids, — so many inches one way, so many inches another way, so many inches another way; thus gaining the idea of measurements in different directions, and from that the idea of extension in different directions. Some pupil may be able at this point to give the word "dimension," but it is quite possible that the teacher may find it necessary to supply the word.

In a similar way the idea of height, of width from left to right, and of width from back to front, as dimensions in different directions, may be developed, and probably the pupils can be led to express these by the proper terms.

Pupils will now be ready to see that in a geometric view but two dimensions are represented, and that in order to represent three dimensions of an object two geometric views are necessary.

Views of Solids. — When a solid is simple and regular, the facts of its form can be shown in two views — the front and top views. These views should be placed in the same relation to each other that they have in the object; that is to say, the top view should be placed above the front view. The top and front views of twelve solids are here illustrated.

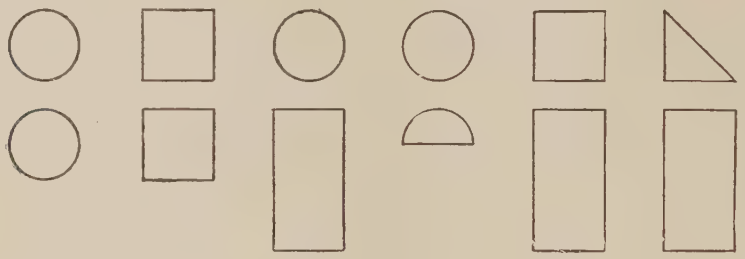


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6.

In the first line of illustrations, the top and front views of the sphere, Fig. 1, the cube, Fig. 2, the cylinder, Fig. 3, the hemisphere, Fig. 4, the square prism, Fig. 5, the right-angled triangular prism, Fig. 6, are seen.

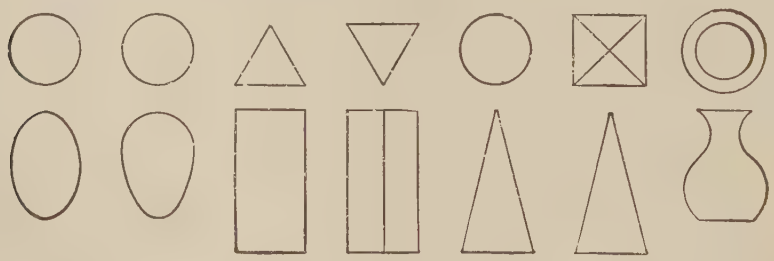


Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 11. Fig. 12. Fig. 13.

In the second line of illustrations, the top and front views of the ellipsoid, Fig. 7, the ovoid, Fig. 8, the equilateral triangular prism facing, Fig. 9, the same with a long edge toward you, Fig. 10, the cone, Fig. 11, the pyramid, Fig. 12, the vase form, Fig. 13, are seen.

It is frequently desirable to have more than two views. In this connection, the triangular prisms show some interesting facts, as will be seen by the study of their views. Take first the right-angled triangular prism in a vertical position. This prism has two right-angled triangular faces, two narrow oblong faces, and a broad oblong face. If it is placed vertically, with one narrow oblong face facing you and the other on the left side, its top, front, bottom, and right-side views will be as in Fig. 1. As in the solid in this position, the vertex of each triangular face points away from the front face, so the vertexes of the triangles in the top view and in the bottom view point away from the front view.

The side view of a solid shows its width directly from back to front, therefore the left and right side views of a solid must be of the same width, and the right side view of the prism in this position must be a narrow oblong, no wider than the left face, although in looking at the right side view, the broader oblong face is in sight.

Fig. 1.

Fig. 2.

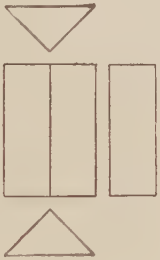


Fig. 3.

Fig. 4.

If the prism is placed so that one narrow oblong face is at the left and the other is at the back, its views will be as in Fig. 2. If it is placed with the broad oblong face at the back, its views will be as in Fig. 3. The right-side view cannot be wider than the width of the solid from back to front, as seen in the top view.

If the prism is placed with the broad oblong face facing, its views will be as in Fig. 4. These views will be readily understood if they are studied from the solid.

The study of the equi. tri. prism placed vertically would also show facts of a similar nature, as may be seen in Figs. 9 and 10, page 22. These are again presented in the study of the equi. tri. prism, with its long edges horizontal from left to right, on page 24.

The left end, front, and top views of the horizontal equi. tri. prism, in various positions, are seen in the illustrations below. In Fig. 1, the prism rests on an oblong face; the front view is not as high as the front *face* would measure, for the front view cannot be higher than the end view. The width of the top view, from back to front, equals the width of the left end.

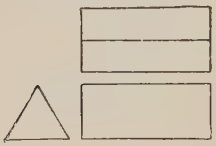


Fig. 1.

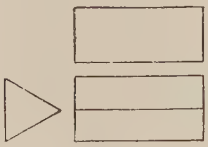


Fig. 2.

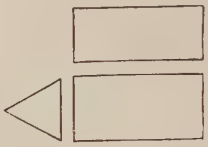


Fig. 3.

Similar facts will be observed in Figs. 2 and 3. In Fig. 2, the prism is supposed to rest on a long edge, with a long edge toward you. In Fig. 3, the prism is supposed to rest on a long edge, with an oblong face facing you.

Manual Training. — Both educators and practical men are now seeking the introduction of manual training into regular school work. Such training will, however, fall short of the desired result, both educational and practical, unless pursued in connection with regular, systematic, thoughtful work in Form Study and Drawing, as Form is the basis of all work in manual training. By means of pattern sheets, definite exercises in regular sequence, and in immediate connection with the Form and Drawing exercises, are provided. Making objects from the patterns also furnishes objects for study, as well as opportunity for care and skill in manual work. The pattern sheets are provided, so that accurate models may be made. Where instruments are provided for children, it will be much better for them to lay out and draw their own patterns, instead of using the printed patterns.

Patterns. — A pattern is anything cut or drawn or formed to correspond to an object to be made, and serving as a guide for determining its exact shape or form and its dimensions.

A flat pattern of a solid is made by what is called the development of the surface of the solid. The surface is, as it were, unfolded and spread out flat, thus making a pattern, which, when folded, will show the form of the solid.

In Book I., the pattern of a cube and of a cubic box, Figs. 1 and 2, page 25, were given.

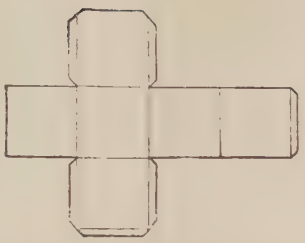


Fig. 1.

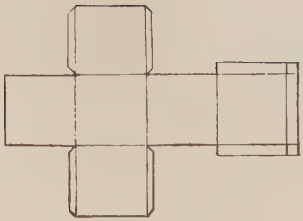


Fig. 2.

In Book II., the patterns of a square prism and of an envelope, Figs. 3 and 4, were given.

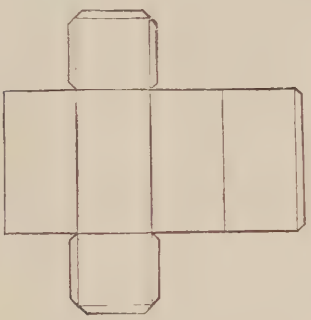


Fig. 3.

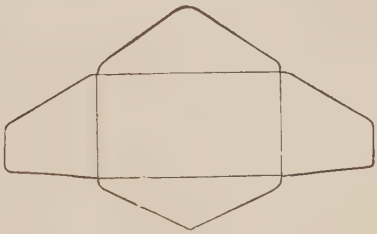


Fig. 4.

In Book III., the patterns of a cylindric box, a square box, and of a cylinder, Figs. 5, 6, 7, were given.

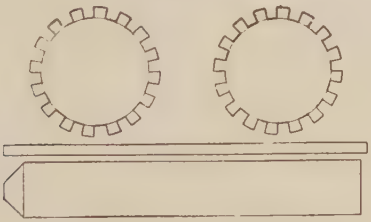


Fig. 5.

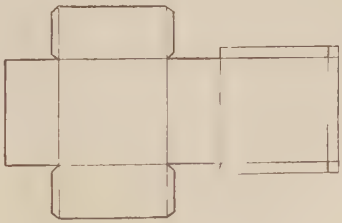


Fig. 6.

Fig. 7.

In Book IV., the patterns of an equi. tri. prism and of a toy house, Figs 8, 9, were given.

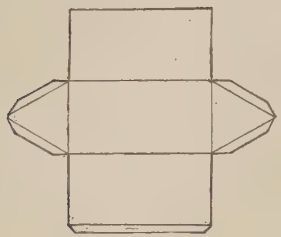


Fig. 8.

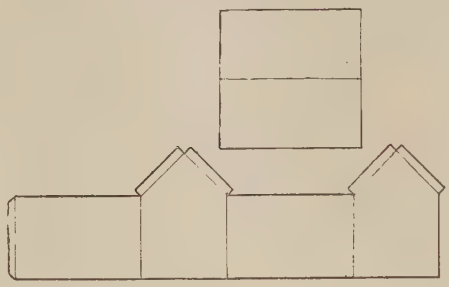


Fig. 9.

Patterns of the body of a cone and of a drinking-cup, Figs. 10, 11, are given to accompany this book.

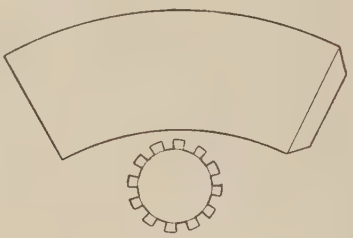


Fig. 10.

Fig. 11.

As these patterns are of manila cardboard, the models made from them preserve their form, and can be used as models and objects in groups.

EXERCISE I. — Cone. — Pattern.

MODELS: *Cylinder, Cone, Triangular Tablets.*

OBJECT. To study the form of a cone, to draw the pattern, to draw the top and front views.

The Cone. — The solid now taken up partakes of the nature of a cylinder. It will stand; it will slide; it will roll. Roll a cylinder on the desk; roll a cone; you find that while a cylinder rolls in a straight line, a cone rolls around a point. The cylinder has three faces, one curved and two plane faces. The cone has but two faces, one curved and one plane face. The shape of the plane face, like that of the plane faces of the cylinder, is a circle; the curved face tapers to a point called the vertex. The cone is a beautiful form; the curves resulting from its sections are the most beautiful and subtile of regular curves.

The cone is a common form in nature; hills, many trees, many roots and vegetables, as radishes, beets, carrots, parsnips, are somewhat like cones. The cone is often seen in manufacture; there are many roofs for towers that are like cones; there are conical hats; covers and shelters of various sorts are like cones; fishing-bobs, tops, and cornucopias are like cones.

Cones, like cylinders, differ in their proportion, and may be higher than wide, as wide as high, or wider than high; in the usual proportion, the height is greater than the width. The proportion of the model is two to one.

The Pattern. — The pattern of a cone may be easily developed by wrapping a paper about it, beginning at the vertex; the paper can be creased about the curved edge, then unrolled, and the pattern of the curved face will be seen creased in the paper. It will be seen that the curve creased in the paper by the curved edge of the cone is an arc of a circle. As the proportion of the cone varies, the curve of the pattern becomes a larger or smaller arc of a circle, as the case may be. The cones made by the pupils for this exercise from the pattern sheets may be used as models for studying the views. They should then be gathered and preserved for use in Exercises II. and VI. Small patterns of cones of various proportions are seen in Figs. 1, 2, and 3, on the Drawing-Book page. With these as guides, patterns may be cut for larger cones, which can be rolled and pasted. If the top of one of these paper cones should be cut off parallel to the base, the part remaining would serve for a lamp or candle shade; and if that part should be unrolled, it would show the pattern of a lamp-shade.

Views of a Cone. — The top view of a cone is a circle, but it differs from the top view of the cylinder, inasmuch as the vertex of the cone is seen. A drawing of the top view of a cone is a circle with a point in the centre for the vertex of the cone. The front view of the cone is a triangle. As this triangle has its two sides equal, it is called an **isosceles** triangle, from two Greek words, meaning *equal legs*.

Fig. 1.

Fig. 2.

Fig. 3.

Illustrations are given here (for the teacher's use) of the three kinds of triangles named from the relative length of their sides: Fig. 1, an equilateral triangle, the three sides being equal; Fig. 2, an isosceles triangle, having two equal sides; Fig. 3, a scalene triangle, having none of its sides equal.

Isosceles triangles, like cones, may vary in their proportions. They may be higher than wide, as high as wide, and wider than they are high. They may be acute-angled, Fig. 4, right-angled, Fig. 5, or obtuse-angled, Fig. 6.

Fig. 4.

Fig. 5.

Fig. 6.

Before taking up the work in the book, the top, front, and bottom views of the cone should be developed at the blackboard, as many pupils working as can be accommodated. The front view should be taken first, as being the most characteristic. The bottom view of the cone is a circle.

Placing Views. — It is desirable to have the adjacent views of a model or object placed on a line with each other. The easiest way to place two views on a line with each other, either vertically or horizontally, is to draw first a light **centre line** for both views. This line generally extends a little beyond the views, to show that it does not represent any part of the object. It may be made a short and long dash line, or a light, continuous line.

The lines by which dimensions are carried from one view to another are called **working lines.** In draughtsmen's finished work, these lines are sometimes drawn short-dash lines, being made of short, even dashes; but for school work, it is as well to make these and the centre line light, continuous lines, as

these serve the purpose equally well and require much less time. The **working lines** should, however, be carefully kept lighter than the lines for the views themselves.

Dictation. — As the pupils advance, it is desirable that the power to conceive should grow in their minds. The mind, like the body, is naturally active and enjoys action, but not in a treadmill way. There must be a new purpose, a new idea, a new difficulty, a new investigation, a new problem, to inspire the mind to its best action. There must be also a certain consciousness of power to meet the new demand. It is the part of the teacher to present the work in such a way as to give the proper stimulus to the growing mind. In dictating the placing of a figure now, do not give minute directions, but lead the pupils to think of it as a whole and to imagine it upon the page in its proper place. The pupils will feel this to be a pleasing appeal to their powers. Their minds will also be directed to the view of things as wholes, which leads to comprehensive thinking on all subjects.

If the pupil has a clear mental picture of the figure to be drawn, the dictation required will be very simple.

Drill.* — The regular work for Exercise I. to be done in the Drawing-Book is to be preceded by a drill exercise on page 1; for directions, see page 30. The quadrant (a quarter of a circle) is to be drawn in the drill exercise, and must be recalled to the pupils before beginning the figure. It will be seen that the movement given for the quadrant is like that for the straight line: one, back; two, back; three, ready, draw. A drill exercise should not be long, and should never occupy more than ten minutes.

To be developed. — Form of model; use of name, cone; shape of pattern; top view, front view; working lines; thinking the figures to be drawn; quality of line.

Suggestions for Study of the Model by Pupils. — Here are two models; name the one which you know. Compare the other model with the cylinder; tell how they are alike, — how they differ. (The teacher gives the name **cone**.)

Take a two-inch square of paper. Place the vertex of the cone at one corner. Roll the paper about the cone, and, holding it firmly about the model, pass your finger around the edge of the model. Unroll the paper. What have you made? (*I have made the pattern of the curved face of the cone.*) What is it like? (*It is like a quarter of a circle.*)

What is the proportion between the altitude and base of the cylinder and of the cone? How should an object be held, in order to obtain a front view? (*It should be held so that only its height and its width from left to right are visible.*) How should it be held, in order to obtain a top view? (*It should be held so that only its width from*

* If the later edition of Book V. is used, this drill exercise may be given upon practice paper.

left to right and from back to front is visible.) What would you draw for the top view of a cylinder? What would you draw for the top view of a cone?

On the cone trace the outline of the front view, beginning at the vertex, moving down the left side, straight across the bottom and up the right side. Trace this outline in the air. Find the tablet having the shape of this outline. How do the two sides of the tablet compare in length? (*They are equal.*) (The teacher gives the name **isosceles triangle**, *having two sides equal.*)

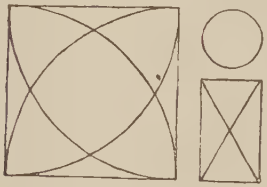
What would you draw for the front view of a cylinder? What would you draw for the front view of a cone? Draw the front and top views of a cylinder of a cone upon the board. How should they be placed? (*The top view should be directly above the front view.*) What can be drawn as an aid in placing the views?

Drawing-Book, Exercise I. — Drawing the Pattern and Views.

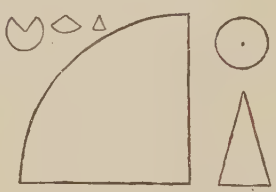
Observation Exercise for Pupils. — What do you see upon this page? (*I see three patterns of cones, Figs.* 1, 2, *and* 3.) What do you think would be the general proportion, as to height and width, of a cone made from Fig. 1? from Fig. 2? from Fig. 3? What are you to do upon this page?

Prang's Pattern Sheet, No. 10. — Making a Hollow Cone.

On this sheet there is a printed pattern of the curved face of a cone. Cut it out, roll and paste to make a hollow cone. Be careful to paste the lap inside.



Drill Exercise, completed.



Exercise I., completed.

Drill Exercise. Practice for Exercise I.

Practice. — Think of an inch — think of half an inch — think of a quarter of an inch — think of three quarters of an inch. Think of a square of such a size, and so placed on the page that the upper and left margins of the page are three quarters of an inch wide and the lower margin half an inch. Move for and draw the square at the count of the teacher. Draw the left vertical, the right vertical, the upper horizontal, the lower horizontal.

Think of a circle — think of a semicircle — think of a quarter of a circle, a **quadrant.** Think of a quadrant in your square — a quadrant from the lower right corner, curving to the left, to the upper left corner. Beginning at the lower right corner, curving toward the left, move for this quadrant to the upper left corner, as for a circle, of which this curve is a part. Move back in the same direction, repeat, and draw at the count of the teacher. In the same way draw the other quadrants.

Think of a circle in the upper part of the space at the right, of such a size and so placed that the highest point in the circle is on a line with the upper line of the square; that the space between it and the square is an inch, and the margin at the right three quarters of an inch. Move for and draw the circle at the count of the teacher.

Think of an oblong as wide as the circle, a quarter of an inch below it, and leaving a margin of half an inch at the bottom of the page. Move and draw at the count of the teacher. Draw the left vertical, the right vertical, the upper horizontal, the lower horizontal. Beginning at the upper left corner of the oblong, draw a diagonal of the oblong. Beginning at the upper right corner, draw the other diagonal.

Directions. Exercise I. — A long horizontal line is printed at the left. At the right end of this draw a vertical line of equal length. Practice movement for a quadrant, connecting these lines, and draw it with one sweep. Correct and finish with a soft, even gray line.

At the right of the page, a line is printed for the base of the front view of the cone. Draw light, indefinite vertical lines, from near the top of the page to the centre of this line and to each end. Upon the centre line place a point for the vertex of the front view and draw the triangle. Decide upon the placing of the centre of the top view. Draw its horizontal diameter, and after practicing movement for the circle, draw with one sweep. Finish in soft, even gray lines.

Alternative Exercise. — If desired, the pupils may draw, on the right side of the page, the front and bottom views.

EXERCISE II.—Cube, Cylinder, and Cone.—Two Views.

MODELS: *Cube, Cylinder, Cone, Triangular Tablets.*

OBJECT. To recall the form of a cube and of a cylinder, to study the form of a cone, to study and to draw the facts of the three solids.

Review. — In the last exercise, the cone was presented in contrast with the cylinder. In this exercise, the cube, cylinder, and cone are studied together. Every teacher will recognize the necessity for review. A rapid review on the solids presented in previous books will be well. A question or two on the sphere, cube, cylinder, hemisphere, square prism and triangular prisms, both right-angled and equilateral, as well as on the ellipsoid and ovoid, will bring out their characteristics, especially if the questions are supplemented with an inquiry for an object like the solid. Such a review will be an excellent introduction to this exercise.

Appearance. — As the facts of the cone and cylinder are fresh in the minds of the pupils through the study of the last exercise, a little time can now be given to observing the appearance of these models. Keep very clear in the minds of the pupils that there is an essential difference between the facts and the appearance, and that both are equally true. There is a truth of facts and there is a truth of appearance. These two ways of studying a model produce different results, but the results do not contradict each other. If the teacher is quite clear on these points, the pupils will be also.

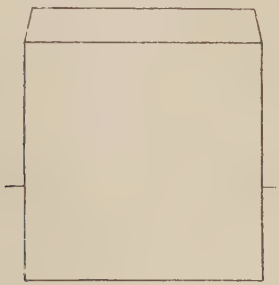


Fig. 1.

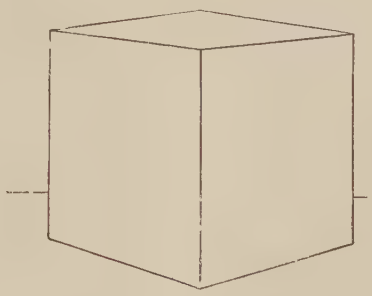


Fig. 2.

Hold the cube facing you and somewhat below the eye; you will see the front face as a square; the top face will appear oblong, being apparently not nearly as

wide from back to front as from left to right; and the left and right edges will appear to converge as they recede. Hold the cube turned with an edge toward you and somewhat below the eye, and notice the visible horizontal edges; you will see that as they recede to the left and to the right they appear also to converge to the left and to the right. You will also see that the two vertical faces appear narrower from left to right than their height, and that the top face appears much narrower from back to front than from left to right.

The cylinder should be studied not only as to the shape of its faces and geometric views, but also as to other aspects. Turn the cylinder in many directions; however you turn it, you can see not more than one plane face and half of the rounding face. Hold it upright and sufficiently below the eye to have the top face in sight. You will see that the top face does not look like a circle, which it really is, but like an ellipse, which it appears to be. Hold it upright and sufficiently above the eye to have the bottom face in sight. You will observe again that the circular face appears like an ellipse.

A similar study of the part visible, and of the appearance of the circular faces when seen obliquely, should be given to the children. The truth of the facts and the truth of the appearance should receive equal attention, so that one shall not obscure the other in the mind of the pupil. Great pains must be taken, however, not to force this seeing the true appearance of objects; unless it comes as what the pupil observes, it will be useless. It would be great folly to tell a pupil what to see. The part of the teacher is to find out what the pupil sees, not to tell him what he ought to see. Fig. 1 shows the top and front views of the upright cylinder; Fig. 2, its appearance when placed below the eye.

Hold the cone upright and somewhat below the eye. You will see that the lower edge appears to curve downward, as seen in the illustration in the upper left corner of Drawing-Book, page 3.

Facts and Appearance. — The drawing of the top and front views of the cone in Exercise I., and the drawings required in this exercise, show the facts of the solids, — they are the basis of working drawings from which objects are manufactured. If the dimensions required were marked upon these drawings, they would be working-drawings. In the illustration in the Drawing-Book the appear-

ance of these solids is given, that is, they are represented as they appear to the eye in certain positions.

Placing the Views. — When the views of more than one object are required on a page, it is well to plan the placing of all before beginning to draw. The distance between the views of an object is not material, except that they should not be so near together as to appear huddled, and thus lose distinctness, nor so far apart as to seem quite separate, and thus lose connection. In this case, the height of the space to be used will determine the distance between the views of the cylinder and cone. The distance between the views of the cone should correspond to the distance between the views of the other solids, so that the page may present a good general appearance.

To be developed. — Review of cube, cylinder, and cone; facts and appearance; objects like cone; quality of line.

Suggestions for Study of the Models by Pupils. — What would you draw for the top view of the cube? What would you draw for the front view?

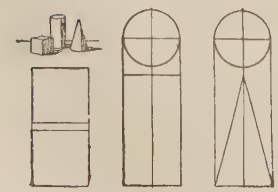
What would you draw for the top view of a cylinder? What would you draw for the front view?

What would you draw for the top view of a cone? How does the top view of a cone differ from the top view of a cylinder? What would you draw for the front view?

Drawing-Book, Exercise II. — Drawing the facts of the Models.

Observation Exercise for Pupils. — What do you see on the Drawing-Book page? Hold the cube so as to obtain the top view, — the front view. Hold it so that it appears to you as represented in the illustration. Repeat with the cylinder and the cone. Can you mention objects like the cone? What are you to do upon the page? Be careful about proper pencil-holding and movement.

Directions. — ***Cube.*** The front view of a cube is printed, — draw the top view, about $\frac{1}{4}''$ above the front view. Move upward from the left vertical, and fix a point for the upper left corner of the top view. Fix a point in a similar manner for the right corner. Draw the left and right verticals, the upper and lower horizontals.



Exercise II., completed.

Cylinder. The base line of the front view is given. Bisect it and draw a light, indefinite centre line. Draw the front and top views, obtaining the place of the top view and its width by movement up from the front view.

Cone. The base line of the front view is given. Bisect it and draw a light, indefinite centre line. Draw the front and top views, placing the top view of the cone on a line with the top view of the cylinder, and obtaining the place of the top view and its width by movement up from the front view of the cone and across, from the top view of the cylinder.

EXERCISE III.—Vase Form.

From a Copy or a Vase.

OBJECT. To study the outline of a vase form; to study reversed curves; to draw a vase form.

Vases. — The first rude attempts at pottery were doubtless in the form of bowls, the only thought being to provide a receptacle; later came the idea of beauty. The eye studied proportion and curvature and effect as a whole, and demanded the production of more and more subtile outlines, easy and delightful to follow but hard to analyze, until the vase form came to be one of the most complete and perfect modes of expression of the attainments of a people, and to hold within itself some of the highest art ideals of the people. By a careful study of the pottery forms of a nation, from the first rude attempts to their highest productions, the progress of civilization in that nation may be traced. Greek vases made of simple clay rank among the finest art treasures of the world; thus art ennobles and glorifies the rudest materials with which it may work.

In pottery, we find most beautiful examples of subtile curvature. In primitive work, all pottery forms were modeled and shaped by the hands alone, but later it was discovered that if a gentle rotary movement was given to the mass of clay, it would assume more quickly a more regular and beautiful form. So the potter's wheel, which could be turned with the clay upon it, arose to aid the forming hands. The illustration below is from the tomb of Beni

Hassan, showing the Egyptians working at the potter's wheel. The first is forming the inside of the cup at the mouth, the second is cutting the cup from the mass, the third shows it completely separated, and held up, while the fourth prepares to begin the process again.

The early potter's wheel was simply a disk placed upon a pedestal, and so arranged that the disk would easily turn at a touch of the hand. The wheel of the present day is often made so that the disk is turned by means of a treadle or of a disk below the table, that can be operated by the foot, thus leaving the hands wholly free to form the vase or jar.

The Spirit of the Lesson. — Try to make every exercise a means of promoting the mental development of the children; incite them to observe, to discover, to express. But try also to make every exercise in some way a stepping-stone to the elevation of the spiritual nature. Lead the imagination out by the suggestion of pleasant and beautiful thoughts, — by word-pictures, by poetry. The cadence and rhythm of verse add to the grace and beauty of the thought. Affected by these, the expression by drawing will become elevated. It will not be mechanical reproduction, but will become thought expression.

Longfellow wrote a beautiful poem called Keramos, the first part of which is quoted below: —

"Turn, turn, my wheel. Turn round and round,
Without a pause, without a sound:
So spins the flying world away.
This clay, well mixed with marl and sand,
Follows the motion of my hand;
For some must follow, and some command,
Though all are made of clay."

"Thus sang the Potter at his task
Beneath the blossoming hawthorn-tree,
While o'er his features, like a mask,
The quilted sunshine and leaf shade
Moved, as the boughs above him swayed,
And clothed him, till he seemed to be
A figure woven in tapestry,
So sumptuously was he arrayed
In the magnificent attire
Of sable tissue flaked with fire.
Like a magician he appeared,
A conjuror without book or beard;
And while he plied his magic art —
For it was magical to me —
I stood in silence and apart,
And wondered more and more to see
That shapeless, lifeless mass of clay
Rise up to meet the master's hand,
And now contract and now expand,
And even his slightest touch obey;
While ever in a thoughtful mood
He sang his ditty, and at times
Whistled a tune between the rhymes,
As a melodious interlude."

Seek also to bring up the pleasant associations that cluster round a vase, — bright, graceful flowers, sweet odors, and the relief of the cool, quiet green of the leaves; still more the pleasant thoughts that go with them as bearers of special messages of affection.

The Example. — A fine example of a vase form is given as a copy for this exercise. The subtilty of curvature in its profiles deserves study, and their reproduction will lead the pupils to a higher appreciation of the beautiful.

It will be still better for the pupils to study from a vase, if the teacher has a vase of good form. Great care should be taken, however, not to give a poor example. So many vases are devoid of beauty of profile and proportion, that it is sometimes extremely difficult to find one suitable for study. The leading thought in all work in Form Study and Drawing should be development through truth and beauty. All art has for its object the true expression of beauty. The models of form and the objects given to the child for form study should be as perfect embodiments of beauty as it is possible to obtain. Imperfect models violate the first principles of the work. It would be much better to study the copy alone than to study a poor vase or model.

Study of a Vase. — In studying a vase for drawing, consider the relative width at top and base. Frequently the width at top and base is found to be the same. The reversed curves given on page 4 * are profiles of vases equal in width at top and base. The proportion between the width at the base and the height must also be considered; a very good proportion is 1 to 3. The *greatest* width of the vase is usually in the body of the vase, and not at the top or at the base, and is generally more than half the height. The curvature of the profiles must also be very carefully considered.

In studying the copy in the Drawing-Book, it will be well to make the base the starting point. The base in this case is one third the height. Imagine verticals carried upward from the left and right ends of the base line through the profile curves; in this way the place where the width of the vase equals the width at the base will be found. Study also the proportion between the width at the top and the base, which is about 3 to 5. Study with great care the general character of the profile curvature.

Drill. — As preparation for the profile curves of the vase, a drill is given upon a series of reversed curves. The drill exercise should not occupy ten minutes.

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* In the later edition of the Drawing-Books, this page is omitted. Its character may be seen by the illustration on the next page. This illustration can be used as the basis of a drill exercise on practice paper from blackboard drawings.

To be developed. — Form of model; profiles; reversed curves; beauty of curvature; proportion; continuous curves; freedom of movement; quality of line.

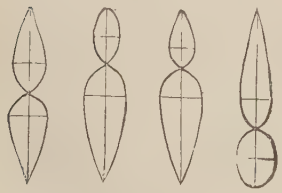
Suggestions for Study of the Vase by Pupils. — What is there pleasing to you about the vase? Will you tell me of what it makes you think? Is it anything like any flowers or seed vessels? Can you tell me about any vase with flowers in it that you have seen?

Drawing-Book, Exercise III. — Drawing the Vase Form.

Observation Exercise for Pupils. — What do you find printed on page 5? (*I find the front view of a vase form.*) Can you trace the profiles in the air with both hands? You can try at recess to draw the vase on the board with both hands. Think of the beauty of the form as you trace the profiles. What is the proportion of the copy? What can you say of its profile curves? (*They are reversed curves.*) Study these curves. Where is the widest part of the vase? At what part of the vase is the width equal to the width at the base? What makes the vase beautiful?

Drill Exercise. Practice for Exercise III.

Study of Curves by Pupils. — What kind of curves do you see on this page? (*I see reversed curves.*) Look at the reversed curve, Fig. 1, and see whether the two curves of which it is composed are circular, or elliptic, or ovoid. Describe these two curves. (*They are ovoid; but although similar in general character, they are not exactly alike, — the lower curve has the greater altitude.*) How is the central line divided? Compare the place of the altitude of the two curves. Study Figs. 2, 3, and 4 in the same way.



Drill Exercise, completed.

Practice. — Fig. 1. Practice continuous movement over the printed curve until its character is felt, — then practice a corresponding continuous movement for a balancing curve on the same central line. Draw the balancing curve with one sweep of the pencil.

Repeat for Figs. 2, 3, and 4, being very careful to keep the free continuous movement, and to remember quality of line. *No erasing.*

Directions, Exercise III. — In the middle of the space at the right, draw a light vertical. Upon this, as a central line, make a drawing of a vase form like the copy. First decide upon the height of the vase. Draw two horizontals, one for the top and one for the base. Practice movement for each curve, first over the printed copy, then for the base to be drawn, and draw the curve with one sweep. Correct, erase incorrect lines, and finish in soft but firm and even gray lines.

EXERCISE IV. — Three Views of a Book.

From a Book.

OBJECT. To study a book as to the facts of its form, to draw the facts of its form in three views.

The Model. — This exercise is to lead to further study of the facts of form and practice in the expression of these facts by drawing, through the use of a book as a model. A book is not made, as most articles are, from working-drawings, and therefore the drawing of these facts of form is not necessary in the manufacture of a book. The model was chosen for this exercise, not with reference to any practical use of the drawings, but because a book is in the possession of every pupil, and will serve well for the purposes of the exercise. The four views given below are those of a quarto dictionary. The facts are there plainly presented in the back, side, front, and top views, the front view being placed at the extreme right, and the top view being placed above the side view. In case of the book, the names of the parts are strongly fixed by custom, and these names are therefore given to the views. If this were simply a block, however, the position of the block would first be given as vertical with broad oblong face facing, and the views would then be named, front view, left-side view, right-side view, top view. This is the better way, unless the object is exceptional in the naming of its parts, like the book, in which case there may be a little danger of confusion. With very few exceptions, the front view of an object means that part directly in front of the observer.

Appearance of the Book. — Hold the book with the plane faces of the cover horizontal, with the back toward you, somewhat below the level of the eye. You see that the width of the top from back to front *appears* much less than it really is, and that the left and right sides *appear* to converge as they recede. Keeping the book horizontal, turn it so that a corner is toward you; you will see that the top still *appears* much less in width from back to front than it really is; you will also see that the horizontal edges which recede toward the left seem to converge toward the left, and those which recede toward the right seem to converge toward the right.

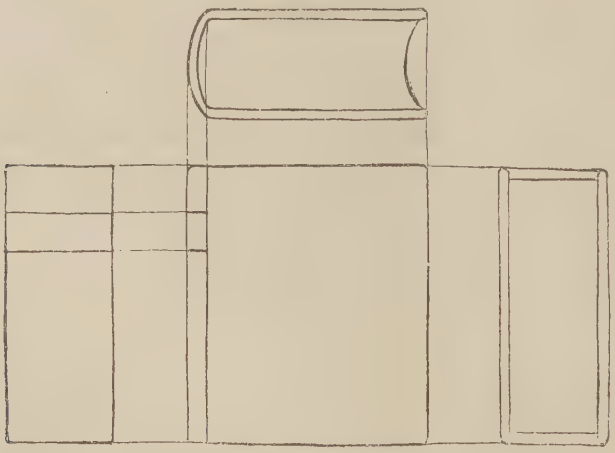
Language Lesson. — The drawing lesson frequently furnishes ideas for work in other studies. This exercise presents many ideas for language lessons. Pupils may be encouraged to learn all they can of the processes in the manufacture of a book — how paper is made, what type is and how it is set, how a printing-press works, how books are folded, how they are bound, through how

many hands a book must pass before it is completed. Some pupils may be able to obtain this information by personal observation, and they can then tell the other members of the class, who can reproduce in writing what they hear. Such written language lessons might be illustrated by different views of a book. Encourage drawing in connection with all other studies; and, still further, give exercises in other studies, which require drawing by the pupils.

To be developed. — Form and proportion of a book; geometric views; foreshortening; appearance of the book; quality of line; free expression of thought.

Suggestions for Study of a Book by Pupils. — Take the thickest book that you have. How many **dimensions** has it? In how many ways should you measure it, in order to give the size?

Hold it upright, so that you get a back view — that is, with the back of the book toward you, — a side view, a top view. Remember that these terms refer to the facts of objects, and that in each case the book must be held so that but two dimensions are visible. Views giving the facts of form — **geometric views** — show but two dimensions. What is the general shape of the back view? the side view? the top view? What is the proportion of the width to the height in the back view? in the side view? Compare the thickness in the back, front, and top views.



Four Views of a Book.

What is there to be seen in the back view? (*The* **title-piece** *may be seen.*) Describe its place on the back.

In the side view, what do you see besides the flat side cover? (*I see that the cover curves out in the back, and thus adds width to the side view; also half the title-piece* **foreshortened**.) In the top view, what do you see? (*I see the curving out of the cover at the back, the corresponding curving in of the leaves in front, and the thickness of the cover.*)

There is no definite rule for the distance in a drawing between any two geometric views of an object; it is generally proportioned somewhat to the size of the views, and to the space to be filled. The views should not, however, be so near together as not to be readily distinguished from each other, nor so far apart as to appear as if they did not belong to each other. The left and right side views should be at equal distances from the front view, for the sake of good arrangement on the page.

Drawing-Book, Exercise IV. — Drawing three views of a Book.

Observation Exercise for Pupils. — What do Figs. 1 and 2 show? (*They show the facts as seen in two views.*) How many dimensions do the two views, taken together, show? What does Fig. 3 show? (*It shows the appearance of the book when lying turned and somewhat below the eye.*)

Hold your book so that it will appear like Fig. 3. Your book may not be of the same proportion as that in Fig. 3, but you can hold it turned and somewhat below the eye, so that the general appearance will be the same.

Drawing. — Draw three views of the book, showing the *facts* of its form. Determine the proportion of width to height in the side view, and draw it, using the angles given for the left vertical. At the left of the side view, draw the back view, determining the proportion of width to height, and obtaining the height by movement and by drawing light *working lines* from the side view. Above the side view, draw the top view, by the aid of working lines obtaining the two dimensions from the side and back views. Finish the three views in soft gray lines.

EXERCISE V. — Drinking-Cup. — Pattern.

MODEL: *Tin Drinking-Cup or a Tumbler.*

OBJECT. To study a drinking-cup; to draw a pattern of a drinking-cup.

Patterns. — Articles of sheet metal are made from patterns. Tin cups, basins, dishes, graters, cans, funnels, covers, etc., are cut from flat patterns or they are stamped out. The drinking-cup chosen for this exercise is like an inverted cone, from which the vertex has been cut, thus leaving the frustum.

Frustum. — The part of a solid next the base left after cutting off the top part by a plane parallel to its base is called a **frustum**; also the part of any solid between two planes which may be either parallel or inclined to each other, as the frustum of a cone, pyramid, etc. The frustum of a sphere is any part comprised between parallel sections, and the middle frustum of a sphere is that whose ends are equal circles.

Care must be taken when this word is used to give it in its correct form — *frustum*. It is often incorrectly given as *frustrum*, probably from an erroneous supposition that it has something to do with the word *frustrate*.

Pattern of the Cup. — Such drinking-cups are cut from flat patterns. The pattern of the base of this cup is a circle $1\frac{7}{8}''$ in diameter. The pattern of the body of the cup is drawn with concentric arcs of a circle at the top and bottom. The bounding lines at the ends of the pattern are parts of the radii of the same circle. The outlines being so easily described, the pattern is not difficult to draw. Prang's Pattern Sheet No. 11 shows the pattern, with laps. The pattern is to be drawn in the Drawing-Book without laps.

Views of the Cup. — In the Drawing-Book, Exercise V., the front and bottom views of the cup are given, Fig. 1. Using a cup or a tumbler as a model, turn it so that you will have a bottom view. You will notice that not only the bottom of the cup is visible, the view of which is a circle, but that the rim is also visible, the view of which is a larger circle; therefore the bottom view of the cup consists of two concentric circles, corresponding in diameter to the diameter of the top and bottom of the cup respectively. The very bad mistake of showing only the bottom of the cup as its bottom view, is sometimes made.

Manual Training. — It will be readily seen how the idea of this exercise could be carried out in making patterns of the articles mentioned above. Com-

pressible drinking-cups, which when not in use are only one third of their height when in use, show an interesting application of this idea. In such work the pupils learn skill and accuracy, and also use their constructive powers.

Language. — A good language lesson on the process of manufacturing tin-ware could be introduced here. The coating of iron with tin, the various machines for forming, cutting, drawing, stamping, etc, are very interesting. Pupils can learn of these processes as they have opportunity, and can give descriptions for the benefit of the class, who can reproduce the descriptions in writing. The life of a tin-cup might be written, giving not only the process of its manufacture but also the various ways in which it had been of service.

To be developed. — Pattern of a drinking-cup; its views; freedom in drawing; quality of lines; skill in making.

Suggestions for Study of a Model by Pupils. — What models which you have studied does this cup most resemble? How does it differ from the cylinder? from the cone? What did you draw for the pattern of a cone? What would it be necessary to do to such a pattern to make it like a cup? (*It would be necessary to cut off the top.*) What would you draw for a pattern of the base? (*I would draw a circle.*) Take a square of paper and fold it about the tumbler so as to make the cone, of which the tumbler is a part. Crease both edges of the tumbler in the pattern. Unfold. What do the creases form? (*The creases form arcs of two circles.*) Which one would form the upper edge of the tumbler? (*The larger circle would form the upper edge of the tumbler.*)

Drawing-Book, Exercise V. — Drawing the Pattern of a Drinking-Cup.

Observation Exercise for Pupils. — What does Fig. 1 show? Hold the cup so as to obtain these views. What do you see in the bottom view? (*I see two circles, one for the rim of the cup, the other for the bottom.*) Observe, also, the top view. What are you to do upon this page?

Directions. — A point is given for the centre of the base of the pattern. Consider the size,* a little less than two inches; practice movement for a circle, then draw with one sweep. Draw the pattern of the body of the drinking-cup, using the angles given. Practice the circular movement from angle to angle, then draw the arc with one sweep. Draw the upper line first. Connect the upper and lower angles by straight lines. Correct, erase incorrect lines, and finish with a broad gray line.

The Prang Pattern Sheet, No. 11. Making the Model. — On this sheet there is printed the pattern of a drinking-cup. Cut out this pattern, roll, and paste to make a cup. Preserve this for study in future exercises.

* At a later stage, when instruments are used, more definite directions can be given.

CHAPTER II.

REPRESENTATION;

Or, Drawing as Applied in Representing the Appearance of Objects.

Representation is the science and art of delineating or representing objects as they appear to the eye. It concerns picture-making. The study of the facts of form of objects in Construction prepares the pupil for the study of the appearance of objects in Representation. Representation is the complement to Construction, and follows it legitimately.

The principles of the two subjects are, however, widely different; for Construction requires two or more *geometric* views, each from a different standpoint, while Representation requires a *picture* from a single standpoint.

Before attempting exercises in Representation with pupils, it is necessary to make plain to them from their own observation that the *appearance* of the form of an object, seen from one standpoint, may be very different from the facts of its form. It must be recognized that instruction in drawing the appearance of objects must relate primarily to instruction in *seeing*, and that pupils fail in drawing the appearance of objects more from inability to *see* than from inability to draw. In general, all persons not trained to habits of correct *seeing* are predisposed toward drawing or representing the appearance of objects according to the idea of the facts of the form which the sense of touch has fixed in the mind. This is easily accounted for by the fact that until within a very few years it has been thought that the appearance of an object must be entirely drawn from a knowledge of principles instead of through seeing. The drawing of the appearance was therefore postponed until pupils were ready to learn perspective. Such a postponement is now considered uneducational, and pupils are now led first to see the appearance of objects and then to state the principles which they have discovered through seeing. But pupils in this grade frequently will not have had the opportunity for such work; special stress must now be laid, therefore, on work in seeing.

Nearly all the principles in this subject can be gained from the study of the appearance of type forms, the simplest geometric solids. These type forms may be broadly classified as —

1. Cylindric forms. 2. Rectangular forms.

But Representation of visible things is not all. The art is more truly called an expressive art, — the art of expressing conceptions, — for it enables a person to express by drawing ideas of things not really existing, — a noble thought or a beautiful idea. The power to think the thought and conceive the idea is inborn; but the power to represent the thought by drawing must be acquired, and generally comes only by careful training.

Why the Appearance of Objects differs from their Facts. — The appearance of an object depends on two conditions: —

1. Its position in regard to the observer. 2. Its distance from the observer.

Position affects the apparent FORM *of an object; distance affects the apparent* SIZE.

The apparent form of any object, except a perfect sphere, varies with every position in which it is placed in regard to the observer.

The apparent size of an object decreases as its distance from the observer increases.

The effect of distance on the apparent size of an object is a matter of common observation. Take a vertical measurement on the pencil (see page 38) of an object at a distance of three feet, and again at a distance of ten feet.

Measurement on the Pencil. — The use of measurement on the pencil is to obtain *proportion*, and when the pupils fully understand the purpose, they will be delighted with the experiments. The teacher draws upon the board at the front of the room vertical oblongs of different proportions. If the school-room is wide, it will be better to have several such oblongs, — some at the left, some in the middle, and some at the right end of the board. The teacher gives the following directions, and sees that each is intelligently carried out before proceeding to the next, explaining that the measurement to be taken first is the width of the oblong; next the height of the oblong. The exercise may be varied by suspending a slate from the blackboard as an object to be measured.

Remember that these measurements give *proportion* only, *not* size.

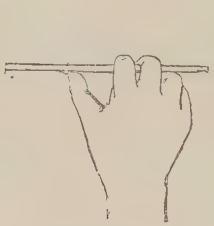
In measuring horizontally great care should be taken that the pencil is *parallel* to the line of the eyes; in measuring vertically, that the pencil does not incline either backward or forward, either to the right or to the left; that it is kept in the same plane, as if against a vertical pane of glass directly in front of the eye.

As it is necessary that the distance of the pencil from the object should be absolutely the same while studying any one object or group, all measurements should be taken with shoulders resting firmly against the back of the chair, pencil held at arm's length; it will be necessary also to take all measurements with one eye closed.

Position and Practice by Pupils in Holding the Pencil for Measurement. — Sit well back in the chair, with head erect and shoulders resting

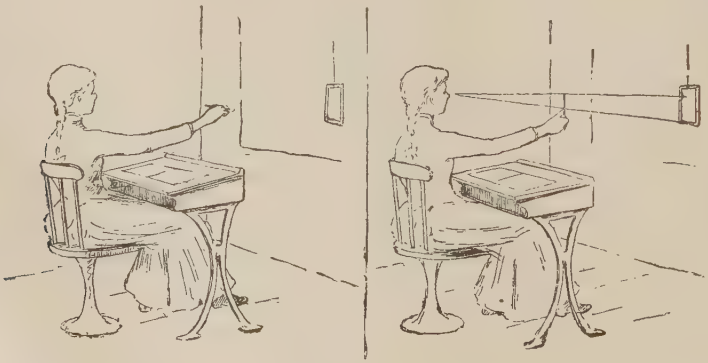
firmly against the back of the chair. Grasp the pencil in the middle with the fingers, leaving the thumb, and, as occasion demands, the forefinger, free to move along the pencil.

Hold the pencil horizontal and *parallel* to the line of the eyes, at arm's length, with the point to the right. Drop the hand to rest. Hold the pencil vertical (not inclining either backward or forward, either to the right or the left), at arm's length, with the point downward.



Measuring Horizontally. — Sit back in the chair, *close one eye*, and hold the pencil horizontal, at arm's length, with the point to the right, and so that the left end appears to be just at the left side of the form or figure to be measured; move the thumb until it appears to be just at the right side of the form or figure, Fig. 1.

Measuring Vertically. — Hold the pencil vertical, at arm's length, with the point downward, at such a height that the upper end of the pencil appears to be exactly on a line with the upper side of the form or figure to be measured; move the thumb up or down the pencil until the thumb appears to be on a line with the lower side of the form or figure.



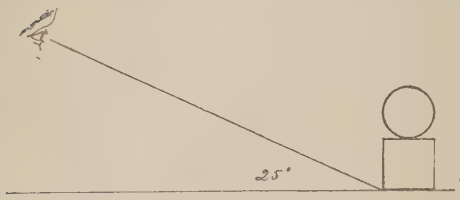
Comparing two Measurements. — Remember always to take the *same* position (back in the chair, pencil at arm's length) for any two measurements that you wish to compare ; *and that the measurements give proportion only, not size.* Take the shorter measurement on the pencil, *keep it by holding the thumb fixed;* turn the pencil and compare this measurement with the longer, by seeing how many times the shorter measurement can be repeated in the longer. Decide carefully upon the proportion between the two measurements.

As a preliminary to the exercises in Representation, this practice can be given in measurement on the pencil. It is not intended, however, that in the early exercises the objects shall be studied by measurement on the pencil, as it is desired to lead the pupils to see approximately the appearance of objects without this aid.

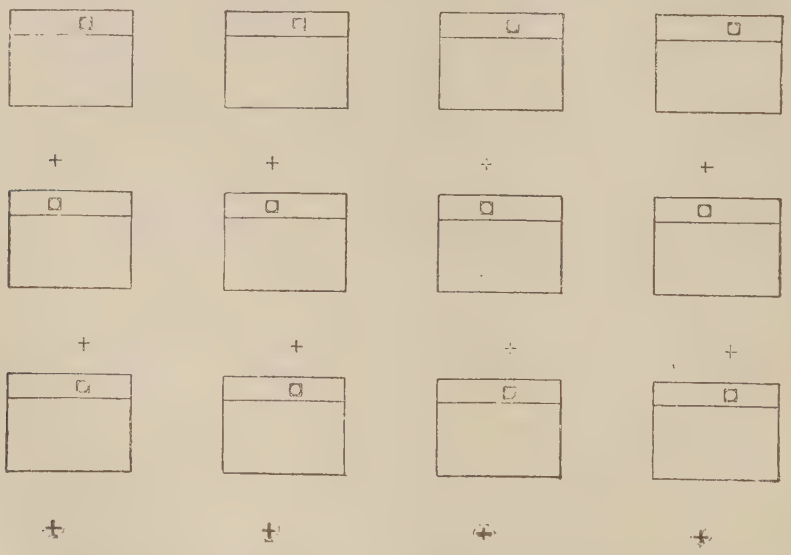
The object of the Exercises in Representation in Book V. is to lead pupils to see, and to express orally and by drawing —

1. *That a circle seen obliquely always appears like an ellipse.*
2. *That the more obliquely the circle is seen, the more nearly the ellipse approaches a straight line.*
3. *That the less obliquely the circle is seen, the more nearly the ellipse approaches a circle.*
4. *That all parallel horizontal edges, receding directly from the eye, appear to converge.*
5. *That the farther of two edges, horizontal from left to right, appears shorter than the nearer.*
6. *That a horizontal face, when above or below the eye, always appears foreshortened.*

Placing Models for the Study of the Appearance. — The appearance will be the most pleasing if the model or group of models is placed so as to be at an angle of about 25° below the eye. If placed at a greater angle, the effort required to see it is greater. This effort to see will be reflected in any drawing of the group by a slight effect of constraint. Such an effect should be prevented by careful placing of the group.



A pupil will not be able to place a model or group upon his own desk so as to be at an angle of 25°, unless the model or group is raised in some way. But he will see the group on the desk in front of him at about the proper angle. The following plan for seating and for placing the models is suggested. It may be found possible, under some conditions, to place the models and to seat the pupils a little farther to the right and left than indicated in the plan given. The model or group is represented by a square, the pupil by a cross.



Let the pupils sit alternately a little toward the left and the right of their respective desks, beginning by having those in front sit at the left. Let those

pupils sitting at the left arrange the group on the back of the desk at the right end; let those sitting at the right arrange the group on the back of the desk at the left end. Each pupil, except those sitting in the front row, can then study and draw the group on the desk in front of his own. If possible, do not have the seats in the front row occupied. This can sometimes be accomplished by having the pupils in the front row take the seats of those who are absent. If this is not possible, let each pupil in the front row arrange a group to draw from on the desk opposite, being careful, however, to place the models or objects somewhat turned on the desk, so that the group may present the aspect desired.

It is important that the drawing for exercises in Representation should be the results of the pupils' own observation; therefore each pupil must study a model or a group, and the teacher must be very careful merely to guide the seeing, and not in any way to force it. Especially do not speak in any way of perspective; they are not intended as exercises in perspective, but as exercises in studying and drawing models and groups as they appear.

EXERCISE VI. — Cone. — Cup. — Appearance below the Eye.

MODELS: *Cylinder, Cone, Drinking-Cup.*

OBJECT. To study the appearance of conical objects; to draw their appearance.

The Models. — The cone and the drinking-cup made from Pattern Sheet No. 11, as each of these objects is based on the *frustum* of a cone. *Frustum* means a piece, and is applied to other solids as well as to cones.

Many objects have the form of a frustum of a cone. The notable example in nature is a volcano, which has not only the form of a frustum but also repeats this form inverted, in the crater. The open frustum is very common in manufactured objects. It occurs in its normal position, in pitchers, liquid measures, crucibles, etc. It occurs in its inverted position, in pails and tubs, in bowls and basins, in tumblers and drinking-cups, in baskets and flower-pots. Its chief use is that of a receptacle for liquids and light solids. No better form has been found for plant jars than the inverted frustum of a cone. It is thus connected not only with the uses of life, but is an almost inseparable accompaniment of the enjoyment of nature within doors.

Facts and Appearance. — While in the exercises in Construction, the main point has been the study and expression of the facts of form, yet occasion has been taken to lead the pupils to the observation of the appearance of the models in connection with the study of the facts. This has been done so that the study of the facts might not, through undue prominence, overpower and weaken the impression of the appearance. While the facts and the appearance are equally true and equally perceptible by sight, yet if either one is dwelt upon to the exclusion of the other, the power to perceive the other and to receive true impressions of it is weakened and after a time becomes dormant. Neither the facts nor the appearance should be forgotten. In leading the pupils to the study of the appearance, therefore, do not forget to direct their observation to the facts.

In this exercise, the appearance of the cone and of an open inverted frustum somewhat below the eye are to be studied. The facts of the upright cone as shown by the front and bottom views are an isosceles triangle and a circle; the outlines of both its curved and plane faces being represented. When the cone is held somewhat below the eye and observed in that position, the plane face is not visible and but a little more than half of the curved face is visible; the curved edge appears to curve downward. The curved face tapers upward and it is therefore possible to see a little more than half of the curved edge. The base will therefore be represented by a little more than half an ellipse, and the profiles must unite tangentially with the curves.

Observing the appearance of the drinking-cup, you will see that the top appears like an ellipse — that the lower curve appears deeper in proportion to its long diameter than the upper one. You will also see that the profiles join the curves tangentially, and that they seem to join both upper and lower ellipses a little in front of or below their long diameters.

Tangential Union. — When a curved line meets another line, so that if continued the curved line will touch but not cut the other line, there is said to be *tangential* union, Fig. 1. If, on the other hand, the curved line meets the other line so as to cut it, there is said to be *secant* union. If you study the union of a branch with the trunk of a tree, you will see that, although the branch shoots out vigorously from the trunk, yet there are always visible beautiful curves where the branch starts, showing tangential union. Tendrils show beautiful examples of tangential union. The same union will be seen between the profiles of a cylinder or a cone and the apparent ellipses at the base; always tangential, never secant, union.

Fig. 1.

Fig. 2.

Table Line. — The cone and the object based upon it, which are to be drawn for this exercise, are to be considered as separate objects. As such, each should have its own table line, as in the illustration of the Drawing-Book page, complete. If one continuous table line should be drawn for both objects, it would indicate that the two objects were drawn together, as if a group. Such a group would violate one of the first principles of grouping, which requires that objects shall *not* be placed in a row. The table line should always be a little lighter than the object.

Drill. — As the ellipse is a regular curve, a facility for drawing it readily can be acquired by practice. A drill exercise on ellipses is therefore given, which should not occupy more than ten minutes.

To be developed. — Appearance of cone and cylinder below the eye; form of frustum of cone; appearance of frustum; relative appearance of curved edges; free drawing; quality of line.

Suggestions for Study of the Models by Pupils. — Hold the cone so that the vertex is on a level with the eye, — lower it four inches; what is the appearance of the edge of the base? (*It appears to curve downward.*) Does it appear like a circular curve? (*It appears like an elliptic curve.*)

Hold a cylinder in the same position; compare the curves of the bases of the models. Can you see any more of the curve in one model than in the other? How do

the profiles join the curve in the cylinder? in the cone? (*The profiles join the curves tangentially in both; but in the cylinder the profile lines seem to meet the curve at the ends of its long diameter; in the cone, they seem to meet the curve beyond the ends of its long diameter.*)

If the top of the cone is cut off, parallel to the base, the part remaining is called a **frustum**. Many common objects are like the inverted frustum of a cone. Can you mention any?

Study the appearance of a large object based on an inverted cone, like a waste basket or a tumbler. How do the curves at the top and bottom compare? (*The curve at the bottom appears deeper in proportion to its long diameter than that at the top.*) If the curve at the bottom is not readily seen, place the basket on a dictionary and a tumbler on a smaller book. The straight edges of the books will contrast strongly with the curves at the bottom of the objects.

Drill Exercise.* Practice for Exercise VI. From the Drawing-Book or blackboard.

Practice. — Three ellipses, differing in proportion, are printed. Practice movement on the upper ellipse, moving in the order 1, 2, 3, 4. Repeat the movement, half an inch to the right of the printed copy, and draw an ellipse with one sweep of the pencil, with a soft gray line. Following the same order, draw ellipses similar to the two others printed.

Drawing-Book, Exercise VI. — Drawing the Appearance of a Cone and of an Object based on a Cone.

Exercise VI., completed.

Directions. — On the left half of the page draw the appearance of an upright cone, somewhat below the level of the eye. Determine the proportion of width to height by measurement on the pencil (see page 46). Draw a central vertical. Determine the place for the diameter of the ellipse at the base, and draw it. Draw the curve for the base. Draw the profile lines of the cone *tangent to*, not cutting, the curve. On the right half draw the appearance of the drinking-cup below the eye. Begin by drawing a central vertical. Draw the upper ellipse and the lower curve, then the profiles tangential.

* If the later edition of Book V. is used, this exercise may be given upon practice paper.

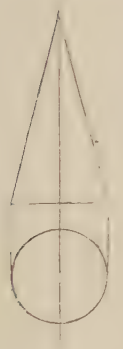
EXERCISE VII. — Cone. — Facts and Appearance. — Object based on Cone.

MODELS: *Cone, Object based on Cone.*

OBJECT. **Continued study of conic objects, to draw their appearance.**

The Models. — This exercise deals with a model and an object similar to that of the last exercise, but it requires further study. The facts and appearance are again presented side by side, and some new thoughts developed. The pupils should be called on to show a decided improvement in this drawing over that on the preceding page.

Facts and Appearance. — The front view of the cone is an isosceles triangle; the bottom view is a circle. For the study of the *appearance*, the cone is placed somewhat below the level of the eye, see page 48. The appearance of the cone below the eye is a "mediation" between its front view and its bottom view. The appearance shows the two sides of an isosceles triangle similar to those in the front view, and at the lower edge shows an elliptical curve, which is a mediation between the straight base line of the front view and the circle which is the bottom view.



The Imagination. — Hitherto in this course the study of the appearance of objects has concerned mainly what was visible; but now the pupils are to be led a step farther, to imagine what the appearance of those parts which are not visible would be, could they be seen.

Hold the cylinder somewhat above the level of the eye; you see that the bottom face appears like an ellipse, and that the upper edge of the cylinder appears to curve upward more than the front part of the lower edge. Hold the cylinder somewhat below the level of the eye. As the top face appears like an ellipse, you can imagine from your previous study and from the appearance of that part of the lower edge which you can see, that if the model were transparent the bottom face would appear like an ellipse, and that the lower ellipse would appear wider from back to front

than the upper one, because it is farther below the eye. So also if the cone below the eye were transparent, its base would appear like an ellipse.

The drinking-cup made for Exercise V. can also be used as a model for this exercise. Study the drinking-cup as the cylinder was studied. If the cup were transparent, the base would appear as an ellipse.

The imagination is here brought into play as to the appearance of the bottom face if it were visible; and this faculty is being cultivated and strengthened so that it will be able to grasp new possibilities. The practical value of this exercise is that the power to imagine the appearance of an invisible face, leads to a comprehension of the amount of space which that face would occupy in a drawing. This comprehension is of great aid in drawing the appearance of models in a group. A common error with beginners is the endeavor to draw two models as if occupying to some extent the same space. This error cannot occur if pupils are led to a complete mental picture of the appearance of the models, as if transparent.

A tumbler will serve well as a model to aid in this study. Always endeavor, when an opportunity occurs, to fix what has been observed in one object by a similar observation of another object of the same general character. Thus it would be well, in studying the appearance of circles seen obliquely, to observe the tumbler above the eye, Fig. 1, as well as below the eye, Fig. 2. It would be an advantage to the pupils if they could bring some plain tumblers for use in the exercise. If the pupils have already studied the appearance of the cone, the double cone may be used.

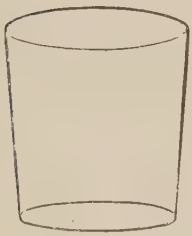


Fig. 1.

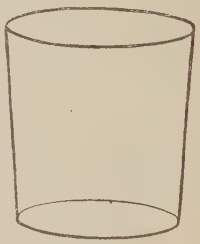


Fig. 2.

Distance. — The effect of the relative distance of the various parts may be expressed by making the line of the farther parts somewhat lighter and less definite than that for the nearer parts. The effect of distance is also increased by making the table line lighter than the model or object.

Profile Lines. — Another important point in studying the appearance of the cone is to note the way in which the profiles of the cone join the ellipse of the base. On account of the tapering of the cone, it is possible to see more than half of the edge at the base when the object is below the eye; the profiles seem therefore to meet the edge back of the diameter of the ellipse, and also to meet it tangentially, pages 51, 52.

To be developed. — Facts of the models; appearance; space occupied; imagination; quality of line; free expression.

Suggestions for Study of the Models by Pupils. — Hold the cylinder somewhat below the eye: what is its appearance? Hold the cone somewhat below the eye; what is *its* appearance? What do you think would be the appearance of the base of the cylinder if the model were glass? the appearance of the base of the cone? How would the base of a tumbler look if the tumbler were held somewhat below the eye?

How does the top of the cylinder appear? the top of the tumbler? Can you find any other example? What do you conclude? (*A circle seen obliquely always appears like an ellipse.*)

Compare the appearance of the top and bottom of the cylinder, and also of the tumbler; what do you conclude? (*The more obliquely a circle is seen, the more the ellipse approaches a straight line; the less obliquely it is seen, the more the ellipse approaches a circle.*)

Study the profile lines and the way in which they seem to meet the base. At what part of the ellipse do the profile lines seem to meet it?

Drawing-Book, Exercise VII. — Drawing the Appearance.

Observation Exercise for Pupils. — What is Fig. 1? What is Fig. 2? In what way is Fig. 3 like the front view in Fig. 1? In what way is Fig. 2 like the bottom view in Fig. 1? What are you to do upon this page?

Directions. — On the left half of the page, draw the appearance of an upright cone somewhat below the level of the eye. Determine the proportion of width to height by measurement on the pencil. Draw a central vertical. Determine the place for the diameter of the ellipse at the base, and draw it. Draw a complete ellipse for the base. Draw the profile lines of the cone *tangent to*, not cutting, the ellipse. Draw a table line for the cone.

On the right half, draw the appearance of an object based on an inverted cone. Begin by drawing a central vertical. Finish each drawing in gray lines, making the nearer parts a little more clearly defined than those farther away. Draw a table line for the object, being careful not to make it continuous with the table line for the cone.

EXERCISE VIII. — Tumbler. — Flower-Pot. — Facts and Appearance.

MODELS: *Cylinder, Cone, Flower-Pot.*

OBJECT. To study the appearance of conical objects; to draw their appearance.

The Models. — It will be well to review rapidly the appearance of the cylinder and cone somewhat below the eye and then pass to the study of the flower-pot. In the front view of a flower-pot, the top appears as a straight line. Place the flower-pot slightly below the eye; the top appears as an ellipse. Place it somewhat lower; the thickness of the pot is seen, showing an inner and an outer ellipse. These two ellipses appear to be quite near each other at front and back and somewhat farther apart at the left and right. This is natural, as you see the width of the top from back to front obliquely; therefore it will appear less than the width from left to right. The two ellipses also appear nearer together at the back than the front. This also is quite natural, as the farther away an object or any part of an object is, the smaller it appears.

You will find again the effect of distance on the appearance, if you study the appearance of the lower edge of the flange of the flower-pot, or of an incised line below the top; the height appears less at the sides than in front, because the sides are farther away.

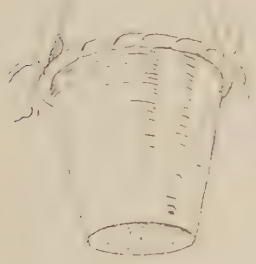
In previous exercises on the appearance of cylindric and conic objects, those have been selected which did not require the study of thickness, so as to have the simplest possible conditions. The flower-pot presents the new condition of thickness.

Placing the Models. — The appearance of an upright cone or a cylindric object remains the same, from whatever side it is seen, if the object remains on the same level. Two such objects for a row of pupils will be quite sufficient. The placing of objects for such an exercise is generally something of a problem. In this case, the solution is easy. Boards may be procured long enough to extend across the aisles between the desks. Two such boards would be required for each alternate aisle, one being needed at the front and one half-way down the aisle. Cleats may be screwed on the ends of the boxes of the desks to serve as supports for these boards when they are needed for the drawing exercise. The

other aisles will be left free for the teacher or pupils. At the close of the exercise, the boards can be removed and put away.

Pots containing growing plants should be in every school-room. These are better for models than empty flower-pots, because the mind then goes beyond the mere form of the flower-pot and takes it in its proper relations, as connected with the life and vigor and beauty of the plant which it holds. It is an advantage also for the pupils to draw a little of the stem of the plant, as this will help them in the study of the appearance of the flower-pot. While they are drawing the flower-pot, they will not fail to see something of the varying mass of leaves in outline and in color.

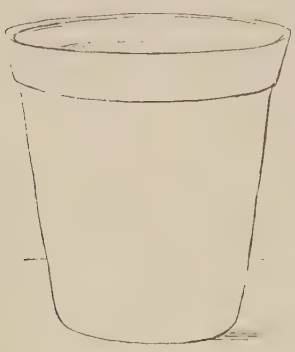
If it should so happen that no flower-pots can be obtained, the waste basket or a pail may be suspended so that it will be not much higher than the teacher's desk, or the basket may be placed on the top of a case. A waste basket is generally a more pleasing object than a pail, as it is less rigid in outline, and recalls less of machinery and more of man. If the object is a pail, turn the handle out of sight, as if seen, it would render the appearance too complex.



The conditions are now just reversed; the object is above the eye. The upper edge appears to curve upward, and being above the eye, appears to curve more than the lower edge. The whole of the base is visible, and its thickness at the edge can be observed in the basket as in the flower-pot. The strings which suspend

the object should be partly drawn, so as to suggest how the object was kept in such a position. Otherwise the drawing would have a very uncomfortable effect.

Appearances Differ. — It must be remembered that an object appears differently according to the distance from the object and the angle at which it is viewed. The appearance of the flower-pot to pupils will be according to their distance from it — those farther away will see it at a less angle than those nearer. Those farther away will also see less distinctly than those nearer. If flower-pots are placed as above suggested, the appearance will be about the same to the pupils in one row across the school-room, to the next row the appearance will be different, and so on. If the drawings of these various rows should be all alike, it would show that some pupils were not drawing just what they saw. It is quite likely also that the flower-pots may not be alike in form. Very probably they may not have as strongly defined edges as those in the Drawing-Book. Perhaps a bit may be broken out of some of the flower-pots; in that case, each pupil to whom the break is visible will have his own individual view of the break, differing from that of every other pupil. In drawing any such defect, it must be only slightly indicated. Too often a blemish in fruit or leaf is drawn in such elaborate detail as to seem the principal thing delineated, and thus draw attention from the more important whole.



As flower-pots are usually slightly irregular, with a rough finish, the outlines should not be as even as those of a finished vase. Every drawing should show a feeling for the character of the material of the object drawn. This is always seen in what is called **artistic rendering.** The drawing of the waste basket should show very few details, and these should be merely indicated.

To be developed. — Facts of a flower-pot; proportion; appearance below the eye; appearance of thickness at front, back, and sides; artistic rendering.

Suggestions for Study of the Flower-Pot by Pupils. — What is the proportion of height to width? What is the actual shape of the top? (*It is circular.*) How does it appear? (*It appears like an ellipse.*) How would the bottom appear if you could see the whole of it? How would the lower ellipse appear compared with the upper one? Why? Look at the thickness of the flower-pot at the top; how many edges has it? How does the inner edge appear? (*It appears like an ellipse.*) How do the two edges

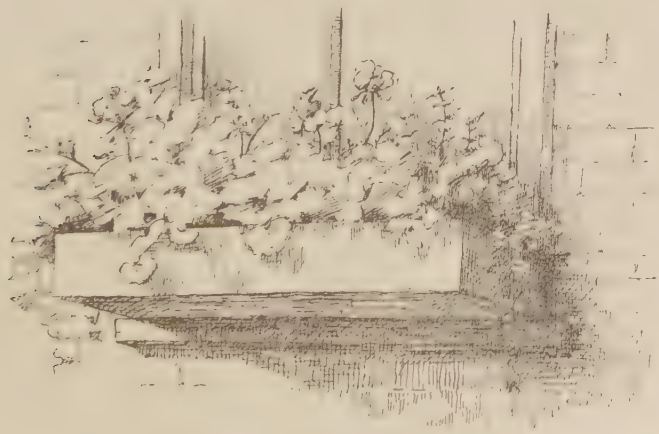
appear as to distance apart? Where do they seem to be nearest to each other? Where do they seem to be farthest apart? How does the apparent distance at the front compare with that at the back?

How does the surface of the flower-pot look compared with that of the cone? Perhaps you can show in your drawing that the flower-pot does not look quite smooth, and thus give a true rendering of its surface.

Drawing-Book, Exercise VIII. — Drawing the Appearance of a Flower-Pot.

Observation Exercise for Pupils. — What does Fig. 1 show? What does Fig. 2 show? What does Fig. 3 show? What are you to do? Are you to make your drawing like Fig. 3? (*We are to make our drawing from a flower-pot and not from any copy.*) For what is a flower-pot used? Where are they usually seen?

Directions. — Draw in the space at the right the appearance of a flower-pot, making a large drawing of a suitable size for the space. Follow the order given in the directions for Exercise VII. Correct errors, erase, and finish with broad, soft gray lines, somewhat irregular, showing the rough and perhaps broken surface of the flower-pot.



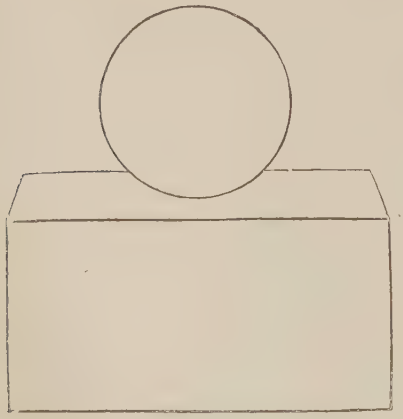
EXERCISE IX. — Sphere on Square Prism. — Appearance below the Eye.

MODELS: *Sphere, Square Prism.*

OBJECT. To study the appearance of a group containing a rectangular solid; to draw the appearance.

The Group. — This group has been given to pupils for study previously in the course. It is now taken up again with reference to an immediately succeeding study of the appearance of a rectangular solid alone.

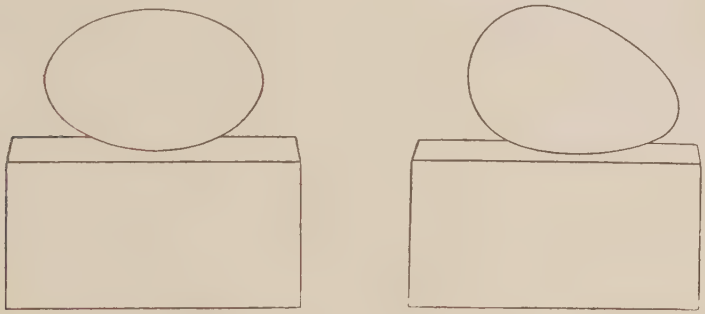
Appearance of the Group. — Place the square prism horizontal from left to right, and on the centre of the top face place the sphere. Hold it on a level with the eye. You see the front view, — a circle resting on the centre of a horizontal oblong. Lower the group until it is at about an angle of 25° below the eye. You notice that the top face is visible, and that the sphere seems to rest on it a little forward of the centre. You see also that the farther edge of the top face of the prism appears not very high up on the outline of the sphere, and that the left and right edges of the top face seem to run toward each other. Draw what you see just as it appears to you.



In giving this exercise to pupils, be very careful not in any way to tell them what they see. Be careful that each has an opportunity to see for himself. For the arrangement of pupils and models, see page 48.

Further Suggestions. — If pupils in previous work have drawn the appearance of the sphere on the square prism, they can draw the appearance of the hemisphere on the square prism, see page 47. Place the square prism as above, and upon the centre of the top face, the hemisphere. Raise the group to a level with the eye. Lower it somewhat below the eye. The top face of the hemisphere appears like an ellipse. The top face of the square prism will appear a little wider from back to front than the top face of

the hemisphere, although they really measure the same. The top face of the square prism will appear wider to you than the top face of the hemisphere because it is farther below the eye. The farther edge of the top face of the square prism will not appear to be very high up on the outline of the hemisphere. The left and right edges of the top face of the square prism will appear to run towards each other, and the hemisphere will appear to be a little in front of the centre of the top face of the square prism, because you are looking down on it. Follow all this with the models in hand, studying carefully their appearance. If you do not see all that has been described, try it again. You will gradually learn the difference between the facts and the appearance, and you will also learn the truth of both.



Group of Objects. — If these have already been drawn, objects like any of these solids may be arranged in groups of two or three, one of them being a rectangular object. In selecting such objects, beauty of form should be kept in mind, as well as a pleasing relation between the objects grouped. Suggestions with regard to selections will be found on pages 37, 57, and 92.

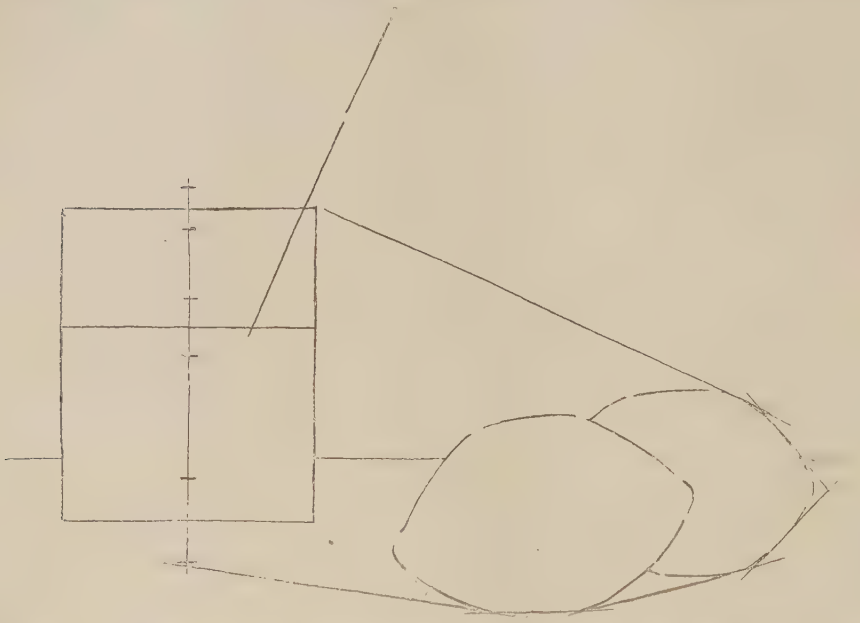
There must also be a thoughtful consideration of arrangement; for a group of objects may be so arranged as to have an unpleasant, disquieting effect, or it may be so arranged as to have a pleasant, restful effect. For suggestions with regard to arrangement, see pages

Blocking-in. — After the arrangement of the group is made, the best way of drawing it must be considered. The first things to be desired are the size of the drawing and the general mass of the group. These things can be attained in the speediest way by blocking-in the group as illustrated on the next page. Other suggestion with regard to blocking-in will be found on pages

Rendering. — The kind and quality of lines used in drawing the group must also be considered. Helpful suggestions will be found on pages 58, 68, and 93.

To be developed. — Facts of a sphere on a square prism; appearance below the eye; foreshortening; convergence; quality of line.

Study of the Group by Pupils. — Place your square prism horizontal from left to right. Upon it place your sphere. Where will you place the sphere so that it will look well? (*I will place it on the centre of the top face.*) Raise the group until it is on



the level of the eye. Describe its front view. Can you see the top face of the square prism? Lower the group somewhat. Can you see the top face now? Is any part hidden? How much of the farther edge is hidden? How high up on the outline of the sphere does the farther edge of the prism seem to come? How do the left and right edges of the prism seem to run? Where does the sphere seem to touch the top face?

Drawing-Book, Exercise IX. — Drawing the Group.

Observation Exercise for Pupils. — What can you think of that is like a sphere? Can you think of something like a square prism? Would it be pleasant to group them together?

Directions. — Consider the proportion of the drawing as to height and width. Study your space and plan for as large a drawing as would be suitable for the space. Draw the front face of the square prism. Draw the top face of the square prism. Draw the sphere.

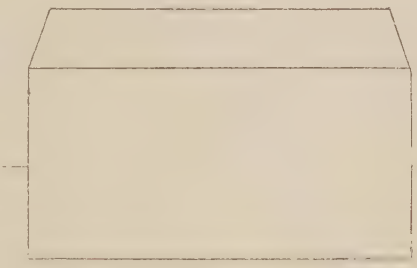
Erase that part of the farther edge hidden by the sphere, and finish the drawing. Add a table line.

EXERCISE X.—Horizontal Square Prism.—Vertical Square Prism.—Appearance below the Eye.

OBJECT. To study the appearance of the square prism below the eye and facing in different positions; to draw the appearance.

The Square Prism. — It is more difficult to realize the appearance of one model alone than when grouped with another, for, in the former case, the model is presented without any relations to any other object. Therefore, in the last exercise, the square prism was given grouped with another model, as a preparation to the study of its appearance when alone, in this exercise.

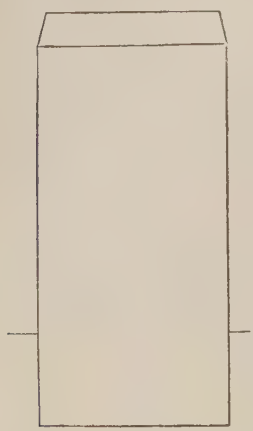
Place the square prism with its long edges horizontal from left to right, and at an angle of about 25° below the eye. As has already been seen in the study of the cube (Book I.), of the square prism (Book II.), of the cylinder (Book III.), and of cylindric and rectangular objects (Book IV.), the width from back to front of a horizontal face somewhat below the eye appears foreshortened; that is, less than its real width. The actual proportion of the top face of the prism as it lies is as 1 to 2; the actual width of the top face from back to front is, therefore, half its width from left to right. But, as you look at the top face of the prism as you have placed it, it appears much less than half the width, and in addition to this, the left and right edges appear to converge as they recede from the eye.



An open oblong box may be of help in studying the appearance of the square prism. The glimpse of the inside of the box and a little thought as to how much of the inside can be seen, adds to the impression of the apparent shape of the top face of the prism.

Place the prism vertical. You observe again that the top face is foreshortened, and that its left and right edges appear to converge as they recede from the eye.

Now compare the appearance of the top face of the horizontal prism with that of the vertical prism, with reference to the width from back to front. The two faces measure alike in this regard, but they do not appear so, for the top face of the horizontal prism appears wider from back to front than that of the vertical prism. This is natural, as it is farther below the eye. If the prism were of glass, you would see that the bottom face of the horizontal prism and that of the vertical prism appear of equal width, because they are at equal distances below the eye, and that they appear wider from back to front than the top face of either prism, because they are farther below the eye. In studying the appearance of an object, therefore, it is well to pay special attention to its distance below the eye, as this will be an aid in considering the appearance.



Conclusion. — This exercise confirms what has already been observed in the cylinder and cylindric objects; that, *the farther a horizontal face is below the eye, the wider it appears from back to front.* This conclusion should be made a special aim in this exercise.

Variation. — If the pupils have already learned to see well the appearance of the square prism, this exercise can be carried out by the use of a box, a writing-desk, or some similar object, as a model. The placing of details, such as the line of the cover, the key-hole, a handle or a hasp, will add to the study.

To be developed. — Appearance of square prism horizontal from left to right below the eye; appearance of vertical square prism below the eye; relative appearance of top faces; quality of line.

Study of the Model by Pupils. — Place the square prism with its long edges horizontal from left to right for the study of the appearance. See placing of models, page 48. Who can tell me how the top appears? Place the prism vertical. Who can tell me how the top appears?

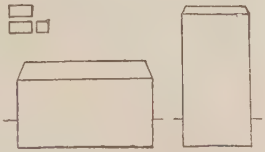
How many inches wide from back to front is the top face of the horizontal prism? What do you say of the width of the top face from back to front in the two positions? (*The width of the top face from back to front is the same in the two positions.*) Study the appearance of the top face in the two positions; how do they compare in this respect? (*The top face of the horizontal prism appears wider from back to front than that of the horizontal prism.*) How can you account for that? (*The top face of the horizontal prism is farther below the eye than that of the vertical prism.*) Find other

horizontal faces at different distances below the eye; what do you conclude about their appearance?

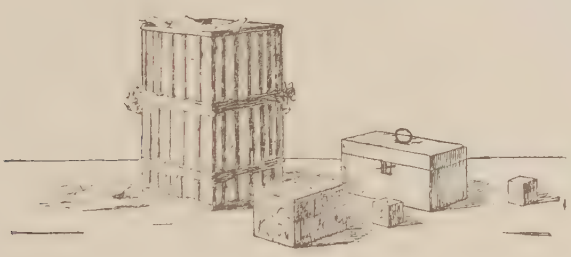
Drawing-Book, Exercise X. — Drawing the Appearance of a Square Prism.

Directions. — Draw the appearance of a square prism, horizontal from left to right, below the eye, using the printed horizontal as the lower line of the front face.

At the right, draw the appearance of a vertical square prism below the eye, making the front face of the same size as that of the horizontal prism. Remember to make an even gray line.



Exercise X., completed.



CHAPTER III.

DECORATION;

Or, Drawing as Applied in Ornament.

Decoration is the science and art of producing beauty in ornament. The study of the facts of form of objects in Construction, and of their appearance in Representation, is now properly followed by the study of Decoration, or the means of enhancing the beauty of objects.

Ornament, the product of purely decorative art, is always employed to beautify objects created for some purpose, independent of their decoration. It produces its legitimate effect when, without concentration upon itself, it makes the object to which it is applied more pleasing than if unadorned.

Fitness to its purpose is the underlying principle, — the very corner-stone of all good ornament. From this principle of fitness for its purpose there arises the fundamental law of ornament, — subordination. This law requires THAT ALL ORNAMENT SHALL BE MODEST AND MODERATE. Strong contrasts and striking effects violate it. Illustrations of this requirement in matters of good taste in general are familiar to all. A loud voice in conversation is not excusable; a forward, self-asserting manner is a mark of ill-breeding; gaudy colors in dress are shunned; showiness, or any other attempt to attract attention, is condemned. This requirement holds good in all ornament, whether architectural, domestic, or personal. He is not well dressed whose dress is conspicuous; that house is not well furnished where the furniture is obtrusive; that building is not well ornamented whose decoration is not subordinate to the idea of the building.

The Sources of Ornament. — The sources of ornament are Geometry and Nature; and it is difficult at times to distinguish between these two sources; for a thoughtful consideration of Nature will show geometric plans and forms and modes of arrangement in her handiwork. Order, symmetry, and proportion are all exemplified in Nature in varying degrees.

Materials of Ornament. — The materials of ornament are —

1. Geometric plans, enclosing figures and units.
2. Conventionalized units derived from natural forms as motives.
3. Historic ornament.

But, in order to use these materials effectively, it is necessary to study —

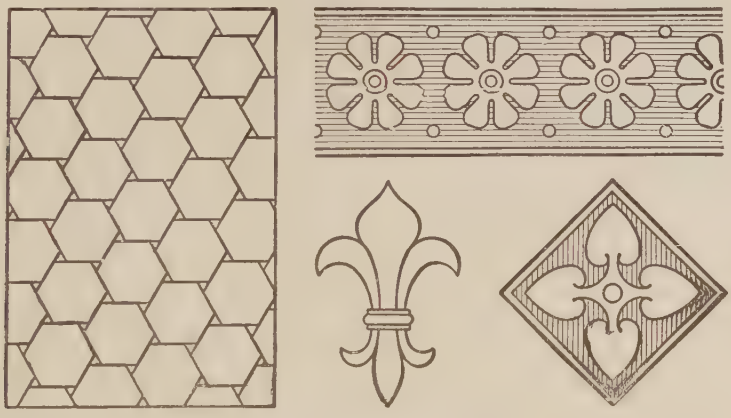
a. Geometric construction and symmetric arrangement.

b. The proper use of plant forms as motives.

c. Well-selected examples of historic ornament.

Symmetric Arrangement. — The principal forms of arrangement (all requiring more or less of geometric construction) are —

1. A surface design, to cover a surface.
2. A border, to limit a surface.
3. A single arrangement, complete in itself.



The *parts* of a design common to the three are —

a. The enclosing figure.

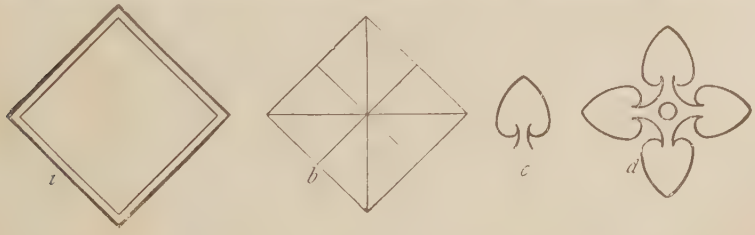
b. The geometric plan, which embraces not only the general geometric outline, but also the lines and divisions required by order and symmetry for the construction of the design, — axes of symmetry and field lines.

c. The units or motives, which are repeated in making the design.

d. The ornament itself, or the filling.

e. The background.

The illustration shows the parts *a*, *b*, *c*, and *d*, of the square rosette.



Proper Use of Plant Forms. — "Flowers must be something more than flowers to the designer; he must seek out the plan of development, and then adhere closely to natural laws." Lead pupils as deeply as possible into the study of nature, in order that they may see for themselves the *spirit* of the plant which they are studying, as well as the more formal matter of arrangement. Then let them *conventionalize* plant forms for use in ornament, by keeping the characteristics of growth, curvature, and proportion, while simplifying outlines and omitting details.

Conventionalization. — The laws of growth, which are recognized and recognizable in all good ornament, are derived from the laws of growth in nature. It would be a mistake, however, to conclude from what has been said that a pictorial imitation of nature is good in ornament A pictorial imitation of nature represents the accidents of growth. Order, regularity, and symmetry are the normal laws of growth, while the irregular is accidental. This idea is developed in the treatment of conventionalization.

"Flowers or other natural objects should not be used as ornaments, but conventional representations founded upon them, sufficiently suggestive to convey the intended image to the mind, without destroying the unity of the object they are employed to decorate. *Universally obeyed in the best periods of art; equally violated when art declines.*"

The subject of conventionalization is frequently misunderstood. Some, having a totally wrong impression of conventionalization, think of it only as a means of taking all the life and grace out of a leaf or a flower, and reducing it as nearly as possible to the hard lines of a geometric figure. This is a wholly wrong conception. True conventionalization searches for the life and the marvellous manifestations of growth in the leaf or flower. Natural leaves are more or less unsymmetrical; a leaf-type would be symmetrical; conventionalization rejects the occasional irregularity, and accepts the beauty of the symmetry of the type-form. Conventionalization has sought in the natural leaf for the beauty of symmetry, the beauty of general form, the beauty of radiation, — or, as it might be phrased, the beauty of stability, — the beauty of proportion, the beauty of general curvature, and renders them in the conventionalized leaf. Every line of the conventionalized leaf can be traced as typical of the natural leaf.

Pupils should be led to seek for type-forms of natural leaves by comparing many leaves of one kind, and to discover and express the peculiar beauty of each type-form. This will be true conventionalization.

The purpose is entirely distinct from that of botanic study. In botanic study, the various parts and organs are studied with minuteness, and all the

wonderful structure is revealed. In studying a flower for decorative purposes, the details are not taken up, unless for some special end; but the general plan as to form is studied, and is rendered with faithfulness to the type-form, and not to the individual.

Historic Ornament. — In the past, many nations have produced certain ornament so repeatedly that the ornament has become characteristic of those nations. As the account of what nations have done is called history, so the ornament produced by nations is called **historic ornament.** Different nations have developed different kinds of ornament; each kind, however, has a character or style of its own, hence styles of ornament are spoken of. The great historic styles are: the Egyptian, Greek, and Roman, — the ancient; the Byzantine, Romanesque, Saracenic, and Gothic, — the middle age; and the Renaissance, which may be called the modern. It is not intended at the present time to introduce any instruction on the different styles of ornament, as that would be quite beyond the capacity of the pupils. The purpose is to give beautiful examples of ornament suited to the ability of the pupils to appreciate and to reproduce. The study of the characteristics of each style is left for more advanced work.

Quality of Line in Decoration. — In Representation, a drawing is intended to represent the appearance of an object, or group of objects, and therefore to express not only the appearance as to mere outline, but also as to distance, as to direction of light, and as to relative importance of parts. It is in Representation, therefore, that what is known as "rendering" is used, giving more emphasis to some parts and less to others, according to their light, their distance, and their value, by lines varying in thickness and in shade.

In Decoration the purpose is different. No effect of light, shade, distance, or value is desirable in flat decoration. A decorative figure should be drawn in the simplest possible way. It should be drawn with intelligence, with strength, with purpose, with firmness. The line should be open in texture, of an even gray color, and of an even width. Venation may be expressed (it should be sparingly, however) by a line tapering in width. Unevenness of line in decorative outline detracts from repose.

EXERCISE XI. — Fleur-de-lis.

OBJECT. To study and to draw an example of good historic ornament.

Historic Ornament. — Good historic ornament is always ennobling, for it is an expression of the best and most enduring feeling: it is, in a very high sense, "a survival of the fittest." A lesson in historic ornament may and should be not merely a lesson in drawing, but also, to a greater or less degree, a lesson in history and æsthetics, in living and in doing.

Fleur-de-lis. — This ornament has been, like most favorite ornaments, variously modified in different ages and countries. It seems to be a type that has found recognition among all people — a type corresponding to a universal thought.

Its origin is disputed: some would derive it from a spear-head; some from the flower that bears its name, the purple fleur-de-lis or flower-de-luce; some from the showy yellow iris or flag. These flowers have, from time immemorial, and in all nations, been considered as symbols of royalty and greatness. Juno, Queen of Olympus, holds the iris in her royal hand.

So also the ornament which is known as the fleur-de-lis, the lily flower, has had its chief place as an emblem of sovereignty. It is found on scepters and crowns; on the head-dress of the Egyptian Sphinx, which stands as a representative of kingly power; on the imperial garments of Greece, of Rome, and of Germany; and as an emblem of the kings of Spain, France, and England. In a mosaic in the church of Ravenna, which is of the time of Theodoric, wife of Justinian, that empress is represented as wearing a crown, from the middle of which rises the fleur-de-lis. There was found at Tivoli the statue of a Roman emperor having a cuirass adorned with fleurs-de-lis.

It is the royal emblem of France, and French scholars have given much study to its history. There is among them a strong disposition to connect the flower with the ornament; but other meanings have been suggested, and many learned dissertations have been written on the fleur-de-lis. Some have paraphrased it as *fleur-de-Louis*, as pertaining particularly to Louis the Good, Louis XI. Others render it *fleur-delices*, while others try to trace the meaning, *flower of the king*. The best authorities, like Larousse and Viollet-le-Duc, do not seem willing to say that the ornament was derived directly from the flower. However this may be, the regal quality of both the flower and the ornament remains.

Ruskin speaks thus in Proserpina: "You may remember that the fleur-de-lys, which is the flower of chivalry, has a sword for its leaf and a lily for its heart." The great popularity of this emblem in France dates from the 13th century.

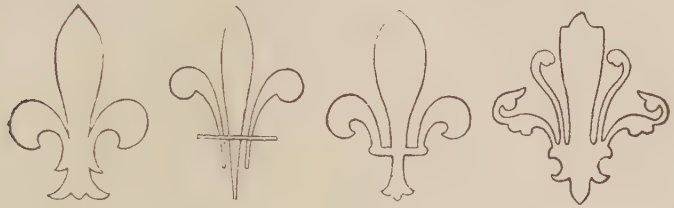


Fig. 1. Fig. 2. Fig 3. Fig. 4.

Various forms of the fleur-de-lis are here illustrated. Figs. 1–5 are of the

Fig. 5. Fig. 6. Fig. 7. Fig. 8.

13th century, Figs. 6–8, of the 14th, Figs. 9 and 11, of the year 1679, and Fig.

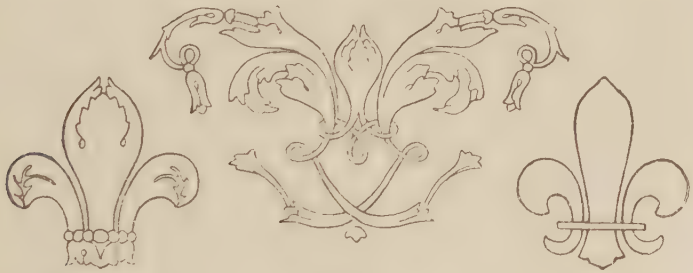


Fig. 9. Fig. 10. Fig. 11.

10, of the age of Louis XIV. These are not only interesting examples of various modifications of one ornament, but they are also interesting as showing the greater simplicity and strength of the early Gothic, in the 12th and 13th cen-

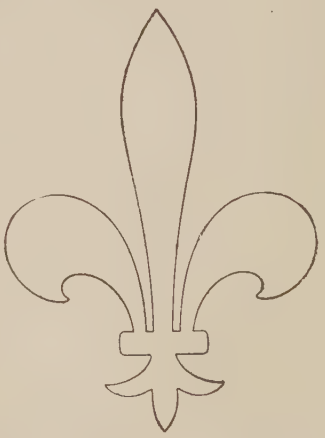
turies, compared with the complexity and overloading of the ornament of the later work. Figs. 4, 6, 9, and 11 are not agreeable in proportion, while Figs. 4–10 lose in character by the many petty details. Fig. 10 is distinctly an outgrowth of Fig. 9, the central lobe being almost identical in the two, and the side lobes of Fig. 10 showing an attempt to modify the side lobes of Fig. 9 by adding acanthus scrolls. The lower part of Fig. 10 seems wholly weak and aimless.

Fig. 12.

When the royal families of France and England united, the fleur-de-lis appeared in English arms. The shield of Queen Margaret, Fig. 12, shows the union of the British lion and the French fleur-de-lis.

The figure used as an end-piece, page 74, is taken from an ancient Greek vase in the British Museum, and is supposed to represent Venus. It will be noticed that the sceptre which she is holding, bears the fleur-de-lis.* It must be remembered that the drawing on these early vases was often incorrect; the example given shows a want of proper proportion between the head and the figure, as well as want of skill in drawing. It is not given as an example of good drawing, but as an illustration of the use of the fleur-de-lis in ancient times.

Its Character. — As has been said, this ornament appears in various modifications in the different ages and countries; but it generally has the broad, erect blade in the middle, the gracefully curving sides, a band or a semblance of one, and a spreading base, as in Figs. 2 and 3 on the Drawing-Book page. It symbolizes dignity and graciousness, and the children may be led to this interpretation. If they reach this thought, the effort to express the same qualities of dignity and graciousness in their work will follow; and, as they think of and try to express these qualities in their drawing, they will learn and attain something of self-respect and courtesy.



Florentine Fleur-de-lis. — The Italian modifications of the fleur-de-lis are very interesting. The upper part only of a Florentine fleur-de-lis is given in Drawing-Book V. for this exercise. The complete figure is here illustrated. The upper part of a fleur-de-lis is often used in heraldry.

* See Millingen's Painted Greek Vases, Plate XVII.

The fine proportions and grace of curvature in this figure should be noticed. Some slight changes in proportion or curvature might change the whole character of the ornament; the necessity, therefore, for very good examples as copies, will be seen.

Drill. — In order to give the character desired to the drawing of the fleur-de-lis, it is necessary to have great freedom of expression. A drill exercise for the spiral affords admirable practice here.*

The Spiral. — There are two varieties of the spiral: the equable spiral, which is the subject of this exercise, and the variable spiral to be taken later. In the first variety, the distance between the different spires is the same, as shown in the Glossary. This is called the equable spiral, because its breadth increases uniformly with each revolution; it is also called the Archimedean spiral, from a Greek mathematician, who lived more than two thousand years ago, and who was the first to define its characteristics.

If a cord were wound around an upright cylinder, or the trunk of a tree, and if a person were then to take hold of the end of the cord, and, keeping the cord all the while taut, should unwind it by walking around the cylinder or tree, his path would approximate closely to that of an equable spiral. The spiral may be illustrated by a blackboard drawing, made with crayon and twine. To do this, fasten a piece of twine closely around a crayon, at about an inch from the end. Sharpen another crayon, and make a little groove around it, at about an inch from the point; in this groove tie the other end of the twine, leaving it loose enough to slip easily about the crayon, but not so loose that it will slip off entirely. Wind the twine carefully around the shorter part of the first crayon, until the two crayons are brought close together. Keeping them in their relative position, place the end of the crayon wound with twine and the point of the sharpened crayon against the board. Hold the former firmly in position, and, moving the latter, gradually unwind the twine from the unsharpened crayon, being careful to keep the twine taut and the point of the sharpened crayon always against the board. The line which this point traces will be the line of the equable spiral, and will explain the curve clearly.

The movement in drawing the spiral is to be entirely different, however, from that described. The movement should be from the shoulder, and the pencil held as for a vertical line. The spiral is to be drawn freely, movement being practiced first over the paper.

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* See illustrations in the Glossary under the word "Spiral." If the later edition of the Drawing-Book is used, the drill exercise can be given on practice paper from the black-board.

To be developed. — Appreciation of the spiral; free movement; sense of proportion and beauty.

Study of the Copy by Pupils. — What is the name given in the Drawing-Book to Fig. 1? to Fig. 2? to Fig. 3? Have you ever seen the flower called fleur-de-lis? Do you remember how some of its petals curve and curl? It is not known that the ornament called the fleur-de-lis was taken from this flower; but the curves at the left and right sides of the ornament are like the curves of the curling petals of the flower.

How would you describe the whole figure? (*It is beautiful; the centre is so straight, and the sides curve so beautifully, that it is very pleasing.*) Where should you think it might be put? (*I should think that it would belong at the top; it is so fine.*) What can you say of the central part? (*It is erect and slender, but strong and well proportioned.*) Of what kind of a person does it make you think? What can you say of the sides?

Drawing-Book, Exercise XI. — Drawing the Fleur-de-lis Ornament.

Observation Exercise for Pupils. — What is the proportion of Fig. 1? About how high can you make your drawing in the space at the right, leaving a suitable margin at the top and bottom? What will you try to express in your drawing?

Drill Exercise. Practice for Exercise XI.

Practice. — Move freely but thoughtfully over the printed spiral; repeat the movement in the space at the right, using the points merely as guides, and draw the spiral, thinking of the spiral rather than of the points.

Directions, page 15. — Draw Fig. 1, enlarged to fill the space at the right. First draw a light centre line, then blocking-in lines, not more than five. Notice the spiral character of the side curves. Before drawing each curve, practice movement to get the feeling of the curve. Erase the centre and blocking-in lines, and finish the fleur-de-lis in broad, even gray lines.

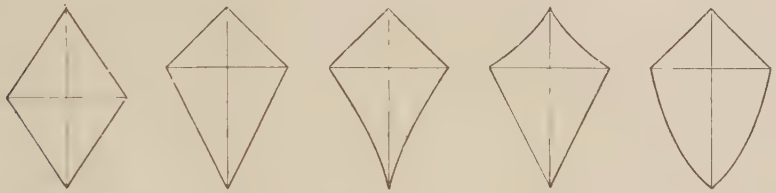
From an ancient Greek Vase in the British Museum. (See page 72.)

EXERCISE XII. — Unit of Design. — Modification of Unit.

OBJECT. To study and to draw modifications of a familiar unit.

The Unit. — As this exercise* presents work preliminary to that of Exercise XIII., it will be necessary to study the two exercises somewhat in connection. The purpose of both exercises is to lead the pupils to original work in modifying the kite-shaped unit, Fig. 2.

The possible derivation of this unit from the rhombus, Fig. 1 in the line of illustrations below, was shown in Manual, Part II., page 54. There were also shown the modifications which the unit might undergo by change of proportion and place of greatest width. Its modification by change of outline was also considered; some of these modifications are illustrated below.



These modifications show units that may be used in arrangements around a centre. The requirement in this exercise is for a unit complete in itself. For this purpose, still further modifications are introduced, to give stability, strength, and variety.

Stability. — Study tree form, and see how stability is there secured. Sketch a tree roughly in mere outline; note the general shape obtained — a strong trunk, broad branching at the top, an expansion at the roots.

Study now Figs. 1 and 4 in the Drawing Book, Ex. XIII., and note the expansion at the root or base, which gives the appearance of stability to the unit. A unit with insufficient expansion at the base is weak. This is, then, an important modification.

Strength. — While considering expansion at the base, provision must also be made for the strength of the unit, which can be best attained by sufficient width of stem or trunk. If the trunk or stem is made too slender, the unit becomes painfully weak. In a tree, the trunk is generally slender in proportion to the width of the branching, but in a tree much strength comes from the growing life. In a figure, strength must be expressed in the trunk or stem by a greater proportional width.

* If the later edition of Book V. is used, this exercise may be given upon practice paper.

Variety. — The unit may be modified by division, so as to secure greater variety; this division may be partial, as seen in Fig. 4 in the Drawing-Book, or entire, as in Fig. 5. In the use of division, care must be taken not to impair the strength of the unit. The divisions of Figs. 1 and 4, a partially divided figure, are held together by the strong undivided stem, as the trunk of a tree holds the branches together. If the divisions are carried too low, there will be an apparent tendency to split, and thus the strength of the unit will be lost.

Pay special attention to the proportional width of parts in these units, the central part being broader than those at the sides. Division of the unit introduces a very beautiful phase of proportion — proportional parts. Note also that these parts seem to grow from the stem, and that their curves, if continued, would pass within the stem. This is an important point.

If the unit is wholly divided, as in Fig. 5, stability may be obtained by holding the parts together by a band. Care must be used, however, to place the band at the narrowest part of the unit, where it would really be of use. The good effect of fine curvature and pleasing proportion may be largely destroyed by placing the band above or below the narrowest part of the unit. The effect given is that of insecure holding, which detracts greatly from the repose necessary in ornament.

Division may also be used in a moderate degree, to give variety to the base.

To be developed. — Modification of units by curvature and by division; proportional parts; strength; beauty; firmness and evenness of line.

Study by Pupils.—Open your drawing-books at Ex. XIII. Fig. 2 is a unit which is already familiar to you by its use in previous books; its base is simply a point. A vertical figure resting on a very sharp point gives an unpleasant impression of being insecurely placed. How is this unit modified in Fig. 3? (*Its shape is made more pleasing by the substitution of curved lines for straight; and it is broadened at the base, giving the impression of greater stability.*) Do you remember the form of a tree, — the strong trunk, the broad branching at the top, and the spreading roots at the base?

How is this unit modified in Fig. 4? (*By division in the upper part and at the base.*)

Drawing-Book, Exercise XIII. — Drawing Modifications of a Unit.

Observation Exercise for Pupils. — What do you find on the page of the drawing-book? What are you to do on this page? What kind of lines should you make?

Directions. — Construction lines are given for two units. On the figure, at the left, draw Fig. 1, Drawing-Book, Ex. XIII.; on that at the right, an original modification of it. Be careful about breaking the outline too much, and making too many sharp points, which are unpleasantly suggestive of thorns and briars. Finish with even gray lines.

EXERCISE XIII. — Unit of Design. — Modification of Unit.

OBJECT. To study and to draw modifications of a familiar unit.

An Advance. — While this exercise is in a certain way like the preceding exercise, it should not be treated as a mere repetition. It is offered as an opportunity to lead the pupils farther toward a higher sense of beauty, obtained through a study of curvature and proportion, and through the effort to express beauty in units of their own design.

The proportion of the figure as a whole must be restudied, and also the beauty of the proportion of the parts one to another and to the whole. The beauty of proportional parts may be illustrated to them not only by the study of the figure, but also by the study of nature. Three-lobed leaves show this regard for proportional parts. The grape and the sassafras are here illustrated, to furnish suggestions of proportional division.

Tangential Union. — The law of tangential union, always observed in nature, should govern decorative design. Owen Jones states this law thus: "All junctions of curved lines with curved, or curved with straight, should be tangential

to each other," or, in other words, they should be so drawn that they would touch but if produced would not cut each other; and he further says: "Oriental practice is always in accordance with it. Many of the Moorish ornaments are on the same principle, which is observable in the lines of a feather and in the articulations of every leaf; and to this is due that additional charm found in all perfect orna mentation, which we call the graceful. It may be called the melody of form."

Tangential union applies to all lines starting from a central line or stem; hence the lines of division in the unit should unite tangentially, the sides branching from the central division and all uniting in the stem or trunk below.

Tangential union is therefore a large factor in the effect of growth and vigor in an ornament, and teachers should make its importance and beauty very well known to pupils. The illustration shows on the right a line uniting tangentially with the vertical; on the left, a line which, if continued, would cut the vertical. Tangential as well as secant union are further illustrated on pages 51, 52.

How to Judge a Unit. — It is not an easy matter for beginners to draw simple and beautiful units, and teachers are sometimes at a loss to know how to help their pupils. It is necessary first to consider the characteristics of a good unit. A unit complete in itself should possess symmetry, proportion, contrast, breadth, stability, and repose, and should be judged

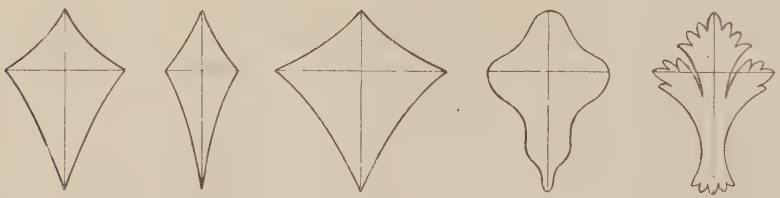


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5.

Illustrations of Bad Units.

according to its possession or lack of these characteristics. Frequently as bad units as these here illustrated will be drawn by pupils. In judging such units, the following questions will be helpful: —

Symmetry. — Is the unit symmetric, or is it one-sided? Pupils should be led to see the beauty of symmetry, by which one part is the reflex of the other, and therefore in harmony with it.

Proportion. — Is the proportion of the unit agreeable as to general dimensions? The effect will not be good if the two dimensions are either very nearly alike, as in Fig. 3, or widely different, as in Fig. 2. If the unit is partially divided, what is the

relative proportion of its parts? There should be a moderate inequality between the central part and those at the side, the central part being larger than the other two. The proportion of each part should be that of slenderness, rather than of breadth. If the parts are made too wide, the unit, as a whole, will lack elegance of proportion.

Contrast. — Is there a pleasing contrast of straight and curved lines, or of inner and outer curves, or of curves and points? There is often a monotony of outline in a unit, produced by several curves of the same sort, Figs. 1, 2, 3, or by continuous curves of no very strong character, Fig. 4.

Breadth. — Is the unit simple? Simplicity is a great beauty in decoration. If the unit is cut up into many petty parts, this beauty is lost.

Stability. — Is the stem of the unit broad enough to be strong? Does the unit expand at the base? If partially divided, would the curves of each part, if extended downward, pass within the stem, or would they cut through it, as in Fig. 5? To be true to the laws of growth, they should pass within the stem. The curves which divide the unit into three parts would, if continued downward, cross the outer lines of the stem. If wholly divided and held by a band, is the band so placed that it can perform its office?

Repose. — Is there anything startling about the unit? Has it many sharp points, as in Fig. 5? or very unusual curves? If so, it cannot be restful. Are the curves easy, flowing, and graceful? The higher qualities of repose are obtained through symmetry, proportion, breadth, and stability.

By considering the units which the pupils draw, in the ways suggested above, teachers will find themselves not only able to criticise the units, but also to develop in the pupils an appreciation of grace, simplicity, and repose in ornament. Lead them also to individuality — to an endeavor to make the unit expressive.

To be developed. — Appreciation of symmetry, proportion, contrast, breadth, repose, individuality, free movement, even lines.

Study of the Page. — What is the proportion of height to width in Fig. 1? (*The proportion of height to width is as* 3 *to* 2.) If you had the height given, how would you get the width? (*I would trisect the height, and make the width equal to two thirds of this height.*) How is Fig. 1 like Fig. 2? How does it differ from Fig. 2? How does it differ from Fig. 3? from Fig. 4? In what way do Fig. 1 and Fig. 4 resemble each other? How do the division lines seem to meet? (*They seem as if they made one line where they meet.*) If they were continued after meeting in the stem, would they or would they not cut each other? (*They would not cut each other.*) Then the union is **tangential union.** Will you come and make upon the board the Arabic numerals from 1 to 9? Please make them of good size. In which of these do you find tangential union? (*I find tangential union in* 2, *in* 3, *in* 6, *in* 9.) The union in 5 and 7, where the lines would cut each other if produced, is called secant union.

What else do you notice in Figs. 1 and 4? Which is the largest division? How do the three divisions compare where they meet? Where is the narrowest part of the unit? Study the sweep of the curves.

Drawing-Book, Exercise XIII. — Drawing a Modification of the Unit.

Observation Exercise for Pupils. — What are you required to do upon this page? How are you going to modify the unit? Study your work on the preceding page, and think a moment before answering. How can you improve upon your preceding units? Endeavor to show in your drawing your own idea of a beautiful unit.

Directions. — Draw Fig. 1 lightly in the space at the right. Draw first the axis; trisect it, and through the upper point of trisection draw a horizontal equal to two thirds the vertical. Modify the shape of the unit by changing the general lines or by rounding angles, and by division. Avoid irregularities and many sharp points. Erase construction lines, and finish the modification in broad, even gray lines.

EXERCISE XIV. — Decoration. — Rosette. — Top View of a Flower.

MODEL: *Five-petaled Flower.*

OBJECT. To study arrangement in the top view of a flower; to draw a rosette from the top view.

Original Decorative Design.—The value of school exercises in original decorative design has long been recognized. It has, however, been considered to lie mainly in the use that may be made of it in industry. But original design possesses a much higher value, in the possibilities which it affords for mental development, through the exercise of the creative ability, guided and refined by the study of the beautiful in nature and in art.

As too often presented, original design has resulted in a medley of meaningless lines and figures, with very little consideration of the principles which are foundational. The exercises have been very much like those of past days in composition, when pupils were given some abstract subject (or were left to choose their own), without having attained any development of the power to think or any training in language.

Similarly, pupils were told to make an original design, without having been led in any adequate way to appreciate or even to recognize the essentials of good decoration.

The exercises in original design have been much too difficult. It has been the aim to have those suggested in the present course suited to the abilities of the pupils, and to have them preceded by such simple study of nature and historic ornament as will lead to a constantly increasing appreciation of beauty in decoration.

Study of Nature. — The study of a flower, as a motive in ornament, which was given in Book IV., is here continued. Flowers of five petals are more abundant than any other, therefore they are suggested here. The flowers illustrated in the drawing-book are the primrose and the phlox. Any five-petaled flower, whatever its size, even a very small flower, will furnish suggestions for a rosette. In this exercise pupils are not asked for an original arrangement, but they are led to nature, a never-failing source of beauty, that they may learn to study the plan, arrangement, proportion, curves, and shapes of nature, and to unfold these, as it were, in a simple decorative figure. This is a delightful exercise for all, and is always enjoyed by pupils, as it is not beyond their comprehension, and it gives them an opportunity to discover the elements of beauty; and so insight grows.

Study a flower, observe its general outline, the arrangement about the centre, the radiating petals, their graceful shape, the way in which they are held at the centre, the stamens and pistils filling the centre. Try to express this in a broad, simple way, by drawing with an even line. You will have a rosette with regular radiating units of beautiful outline, and a strong, simple centre. The details of stamens and pistils are too minute for representation here — the result would be only dots, which would seem characterless. The centre of the rosette, holding the units together, is simply a reflex in the drawing, of that mysterious power of life that sends out the flower and holds the petals with a circling hand.

Besides the wonderful beauty of appearance and the marvellous physical structure of a flower, there lies within it a perfect manifestation of order, of symmetry, of proportion, of unity, of æsthetic beauty. The æsthetic is the highest type of the ideal. In studying a flower for a motive of ornament, the attempt must be, through the study of the flower, to reach its ideal.

Rosette. — A little time should be given to the technicalities of the figure. A rosette is a decorative arrangement around a centre, resembling a rose; hence the name, which is a French word, meaning *little rose*. The term is applied most distinctively to circular figures, but it is also used technically in reference to square and oblong figures. Suggestions for oblong rosettes are found in flowers, as in the hydrangea.

A rosette may or may not have an enclosing figure. When it is desired for any reason to call particular attention to the shape of a rosette, or to indicate more clearly its fitness to occupy a certain place, an enclosing figure is added to emphasize the shape. A rosette is usually made up of symmetric units, which occupy equal *fields*. A field is that part of the ground of a design that a unit is to occupy. The number of units, in the special case of this exercise, is determined by the petals in the flower chosen. To aid in preserving the symmetry and order of the rosette, the axes of the units must be drawn. In a circular figure, the radii of the circle will serve as axes of the units. A **radius** (plural, *radii*) is a straight line from the centre to the circumference, or bounding line.

The unit, however, must not touch the enclosing circle, for that would give a crowded look; a feeling of restriction and constriction would ensue, and the repose of the figure would be lost. A space, therefore, should be left between the ornament or filling and the enclosing figure; at least two thirds of the ground should be filled. A skilful teacher will lead pupils to these conclusions.

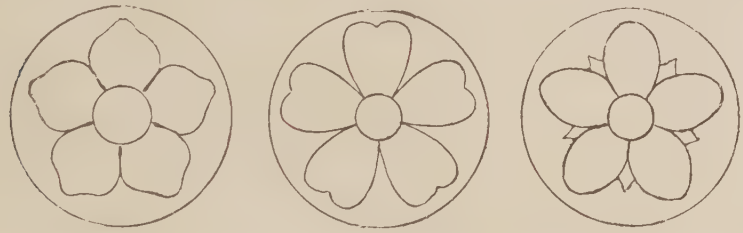
To be developed. — **Study of nature to reach its ideal; simplicity, order, symmetry, unity, beauty; insight; simplicity of line.**

Study of a Flower by Pupils (each having one, if possible). — What do you think of your flower? What makes it so beautiful? (*Its color is beautiful; it is delicate; its shape is pretty; it is like a circle, but the edge is broken; the petals radiate from the centre, they have graceful curves.*)

How many petals has the corolla? What is the general shape of the centre? What is in the centre of the flower? (*There are stamens and pistils.*) These are too minute for us to consider now. What holds the petals together? What can you put in your rosette that will suggest this?

Have you more than one flower of this kind? If you have, study all of them, and compare the petals, so that you can draw a rosette that will make you think of this flower. In your rosette the petals must be alike, for you do not wish to show any irregularities or shortcomings of the flower; you do not wish to *imitate* your flower, but to show what you have discovered of its plan, of its beauty of outline, of the graceful curve of the petals, of their proportion and arrangement.

Can you think of an object which you can make and decorate with a rosette, used either simply, or repeated for a border, or for a surface covering?



(The teacher should encourage the pupils to use the rosettes drawn in decorating some object, by drawing, by cutting, by embroidery, by carving, or by painting.)

Drawing-Book, Exercise XIV. — Drawing a Rosette from a Flower.

Observation Exercise for Pupils. — What do you see upon the page? (*I see pictures of flowers; the flowers have five petals; the flowers growing in the cluster are different from those put together in a bunch; the shapes of the petals are different. I see the faces of some of the flowers, and some are turned.*) Hold your flowers facing and then turned in different positions, and notice the change in appearance. What else do you see on the page? What are you to do?

Directions. — A circle is printed. Within the circle draw a rosette from your flower, making the rosette a little smaller than the circle. Divide the circumference into five equal parts; first draw the petals lightly, using each radius as an axis for a petal. Add a central circle of proper proportion to the rosette. To limit the size of the rosette, make a point on each radius about ⅛″ from the circumference. Finish the rosette in even gray lines, *or* color the rosette with a flat wash.

EXERCISE XV. — Decorative Design. — Border.

MOTIVE: *Five-petaled Flower.*

OBJECT. To consider some of the applications that can be made of rosettes; to design and draw a border.

Beauty in Decorative Design. — There is in man an innate sense of beauty, and there is also a desire to express the feeling for beauty in some way. Being himself a conscious unit, and thus having a sense of unity, he is pleased to make something which is a whole — which is complete. Thus in his work he naturally seeks to produce unity, which is an essential of beauty in decorative design. He has also an inborn feeling for symmetry, for proportion, and for rhythm. He is himself symmetric and well proportioned, and rhythmic in his motions, and he enjoys the reproduction of these effects, so elemental in beauty, either by himself or by others; for they mirror what is a part of himself. So the nature of the child impels him to the production of these effects in his creative work, and then responds with pleasure and delight in the result. It is easy to build upon these natural susceptibilities, and thus guide the pupils to a fuller and more complete sense of beauty in ornament, and develop their ability to produce this beauty. But these must be matters of growth. For a long time the work must be of the simplest character and quite within their understanding. Too much abstract and abstruse material has been given to pupils for use in decorative design, and the result has been bewildering instead of ennobling.

Borders. — A border, however simple it may be, appeals to the sense of unity, for it generally limits and separates from other things the object on which it is used; thus it leads to the recognition of the object, as a whole, complete in itself. It appeals also to the sense of symmetry. It will be remembered that symmetry of the whole is produced by a balance of its parts. In a simple border the upper and lower halves balance each other.

Proportion in an object as a whole, as has been already stated, is produced by the unequal relation of its parts. The contrast between the extent of a border and its width satisfies the early sense of proportion. Later, we have the proportion of the units to the background, and of the border to the surface or object which it limits.

The repetition in a border appeals by its regular succession to the sense of rhythm. For as in music rhythm is produced by a regulated succession of sounds, so in ornament rhythm is produced by a regulated succession of forms or figures.

Doubtless, borders were the first form of decoration on pottery. The first attempts were extremely rude, mere scratches, either vertical or oblique; but by their repetition, which corresponded to the innate sense of rhythm, they gave pleasure. As this repetition grew into continuity in the border which limited and thus completed the object, additional pleasure from the unity produced was awakened. Later, simple figures were used. In illustration of savage ornament, both of the past and the present, many such borders will be found. This early work has not been confined to geometric figures. Racinet, in his "Polychromatic Ornament," gives examples of savage ornament, in which the top views of flowers and conventionalized branches of leaves occur. In India, one of the methods among the natives of teaching design is to give children the petals of fresh flowers, which they may arrange in moist sand to make rosettes, and borders, and surface coverings. Thus these native children learn beauty of proportion, of curvature, and of color, from the tender beauty and grace of the flower.

The Motive. — When any particular object or figure or style of ornament suggests to the designer the thought for his design, such object or figure or style is said to be the *motive* of the ornament. In this exercise, a border is desired, in which the motive is to be from a flower. The border is to be made by a repetition of rosettes from a flower. As has been said, the rosette from the top view of a flower is used in the primitive styles of ornament; it is also found in the highest ornament. Yet it is quite within the reach of the children. For this exercise, the children may bring fresh flowers or they may use the rosette of the preceding exercise.

Repose. — In all ornament there should be repose. This is one of the highest principles in design, but it should be sought even in the most simple work, for it may often be obtained through most simple means. Illustrations of three simple borders are given in the Drawing-Book. These illustrations show the manner of placing the rosettes. It should be noted that to secure repose, the rosettes must be placed at equal distances and in the same position, so as to secure the rhythm of regular recurrence, one of the elements of repose. The rosettes should also be placed so that the single petal will be at the top, otherwise a feeling of unrest is created. This statement can be easily verified by inverting the book, and thus getting the uneasy effect of the inverted rosette. These are very simple matters, but if violated, will mar the best design. The middle border,

while allowable, is not as desirable as the other two, as it suggests rather a part of a surface covering, than a border.

Color Study. — Color having been accepted by leading educators as an important means of acquainting a child with his surroundings and of promoting his mental development, some provision should be made in all schools for its study. An opportunity for a short exercise in color is here afforded.

In all schemes for color-lessons, the color sense should be made the starting-point. Be careful, therefore, always to present a color first, and allow the children to receive the color impression or sensation. After the children have found other examples of the same color, then give the name of the color.

Cutting various figures from colored paper is a valuable aid in training the color sense. Make your standard as to neatness, care, and accuracy in cutting and making, very high from the first. In cutting a circle, it will be found helpful to give a slight rotary movement to the paper as well as to the scissors. Scissors should be a part of the outfit of every elementary school. During the process of cutting, the eye of the child is being filled with the color, and his standard of the color is being formed. It is, therefore, of the utmost importance that the colored papers used should be of good color; it will not do to use any color that may be at hand. The purpose of cutting from colored paper in certain exercises is not only to render the exercise more real and of greater interest to the child, but also steadily to cultivate his color sense, giving him good standards of the principal positive colors. This will prepare for the study of tints, shades, and other modifications. In order to study these modifications properly and also the harmony of color, the foundation colors must be right.* These colors must not be considered by themselves, but in their relation to each other.

Where teachers are prepared by previous training in water-color, and where the conditions are such that the children can be supplied with good material, the use of water-colors and the brush is suggested.

This exercise (as well as Exercises XI., XIII., and XIV.) affords an excellent opportunity for rosettes and borders in colored paper in two or three tones. The three intermediate colors, red-violet, red-orange, and yellow-orange, with light and dark tones, would be excellent material † if previous color study has prepared them for this work.

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* Mr. Louis Prang has been working, as is well known, for years at the color problem. After repeated patient, long-continued study and experiments, the preparation of good colored papers adapted to the cultivation of the color-sense has been undertaken. The Prang Colored Papers for the positive colors, tints, and shades are now ready, and can be obtained through The Prang Educational Company.

† See also "Suggestions for Color Instruction," published by The Prang Educational Company.

To be developed. — Use of a rosette; purpose of a border; idea of rhythm; repose; freedom and quality of lines.

Study by the Pupils. — Who will tell what we drew in our last exercise? Can you tell of any use that may be made of a rosette? Tell the different ways in which it may be used for decoration. (*It may be used as a single arrangement, or repeated to form a border or to cover a surface.*) Can you see any arrangement of rosettes in the room? Can you mention any that you have seen? (*I have seen rosettes in our oil-cloth. I have seen rosettes in a carpet. I have seen rosettes in embroidery and in curtains. I have seen rosettes in wall paper, and in wall-paper borders. I have seen rosettes in the border of a carpet. I see rosettes making a border on my book cover.*) Can you bring an example of a rosette used in a border? Why are borders used? (*I think that they are used to make things pretty, to make them look finished, to make them beautiful.*) You may study your flowers for a rosette to be used in the border.

Drawing-Book, Exercise XV. — Drawing a Border.

Observation Exercises for Pupils. — Open your books at Exercise XV. What do you find? How does the middle border differ from the other two? Turn your book around so that the top will be at the bottom. How do the rosettes in the first and third border look? (*They look as if they were standing on their heads.*) Is that a restful position? Turn your book again, and notice how they are placed.

Directions, page 19. — Through the points given, draw long horizontals as marginal lines for a border, extending as far to the left and right as the borders above. Trisect the second horizontal from the top and bisect each division. From each point of bisection draw a vertical as a centre line for a rosette. Find the middle of each vertical. Consider these points as the centres for circles. Draw lightly three circles, as large as will look well between the marginal lines. Divide each circumference into five equal parts. From these points of division draw five radii in each. Then proceed to draw the rosettes as directed for page 16, beginning in the circle at the left. Erase the centre lines and radii, and finish in broad, soft gray lines.

CHAPTER IV.

REVIEW.

Construction, Representation, Decoration.

Review. — It is desirable, as the end of the term approaches, to review the three subjects — Construction, Representation, Decoration — in order to fix the principles of this book before passing to another book, and perhaps another room and another teacher.

EXERCISE XVI. — Sphere and Square Prism combined. — Drawing the Facts. — Three Views.

OBJECT. To study and to draw the different views of two models combined.

Combination of Solids. — After having studied the views of objects singly, it is well to study the views of a combination of solids. The sphere was placed on the square prism to form a group for the study of the appearance for Exercise IX. The two models are here combined, that the facts of the combination may be studied and drawn. In drawing the views of a combination, the facts to be expressed are the same as in drawing the solid. The front view shows the height and the width from left to right; the top view shows the width from left to right and from back to front; the left-side view shows the height and the width from back to front. The pupils should be led to describe these combinations, and should also be called upon to draw them on the board.

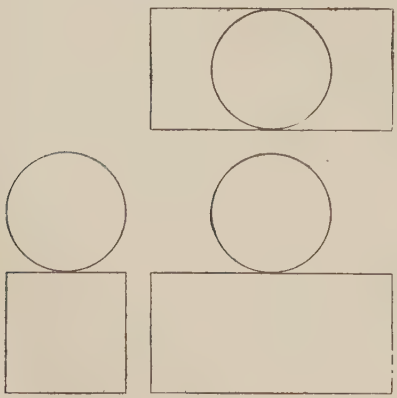


Fig. 1.

Alternative Exercises. — If the teacher prefers, combinations of other models can be made, or the views of some simple object can be required; but it will be necessary to consider carefully the difficulties of the combination or of the

object, and also to study the space, and plan definitely the placing of the views before giving the exercise. It will be well also to make the drawing so as to be sure that the combination or object does not present too complex conditions.

It is not as easy to substitute one exercise for another in drawing as it is to give a new example in arithmetic for the application of a certain principle. The time now allotted for drawing is so short that every exercise that is given must be selected with the utmost care, so that as much as possible may be accomplished by means of each exercise. The ground to be covered is so great that there must be very careful planning in order to reach the essential points. It would not do, then, to select a substitute for this exercise hap-hazard. The previous work in construction must be fully taken into account. Some combination of solids will probably be the best exercise to give here.

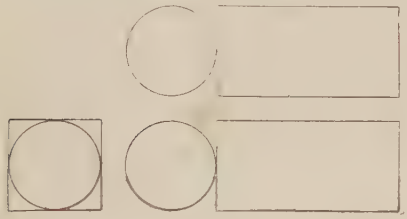


Fig. 2.

The sphere might be placed touching the centre of the left end of a square prism, horizontal from left to right, and the front left-side, and top views required, Fig. 2.

The square prism might be placed with long edges horizontal from left to right, and the cylinder, horizontal from left to right, placed upon it, three views being required, Fig. 3.

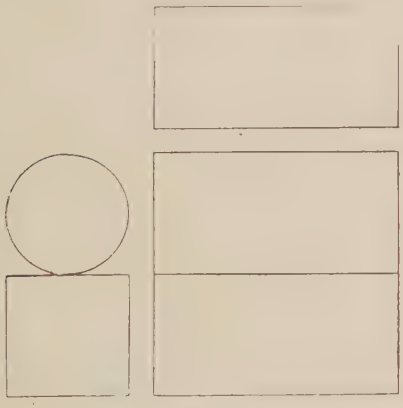


Fig. 3.

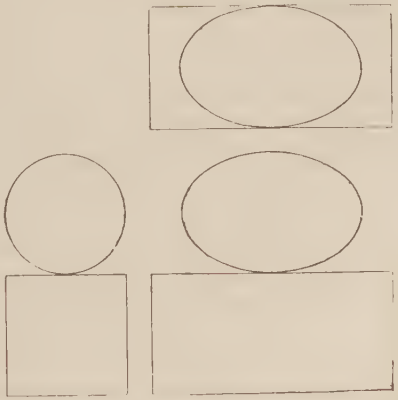


Fig. 4.

The square prism might be placed similarly, and upon it, in a similar way, might be placed either the ellipsoid, Fig. 4, the right-angled triangular prism, Fig. 5, or the equi. tri. prism, Fig. 6.

All of these will be valuable as reviews, and any or all of them might be given to great advantage for quick work on the blackboard, preceding the work

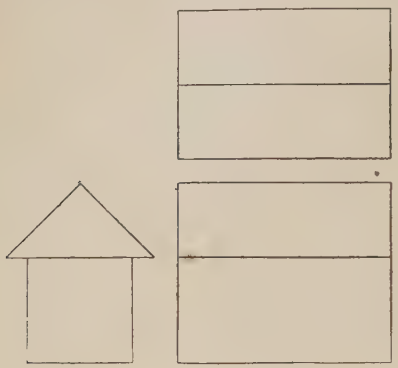


Fig. 5.

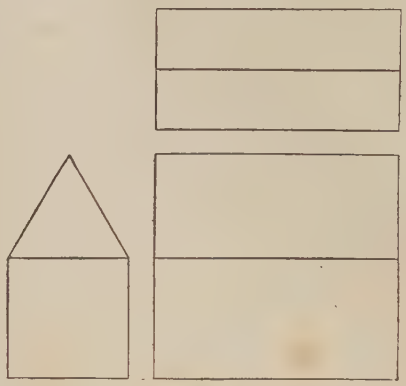


Fig. 6.

in the Drawing-Book. It may be well to give the pupils an opportunity to do the work for this exercise by individual study of the models, without suggestions of any sort from the teacher.

If pupils are very familiar with the models, these exercises may be given from memory.

Drill. — As there are several circles to be drawn in the border, it may seem desirable to give a drill exercise that will call for circles. A border of circles is therefore suggested, that may be given as practice for this exercise; or it may be given as practice for Exercise XV. If, however, drill does not seem necessary for either of these exercises, the page can be used for an exercise in Construction, Representation, or Decoration, according to the need of the teacher.

To be developed. — Views of combinations of models; appearance of combinations; quality of line.

Study of the Models by Pupils. — Place a sphere on the centre of the top face of the square prism, as in the illustration in the Drawing-Book.

Lift the book until the top of the square prism is on a level with the eye, and study the models. What is the proportion of the square prism? (*The proportion is as* 1 *to* 2.) How do the two models compare in size? What would you draw for the front view? (*I would draw an oblong,* 1 *to* 2, *with long sides from left to right, and above it, touching the middle of its upper side, a circle having a diameter equal to the short side of the oblong.*)

Turn the left end of the book toward you; what would you draw for the left-side view of the models? (*I would draw a square, and, touching the middle of its upper side, a circle having the same diameter.*)

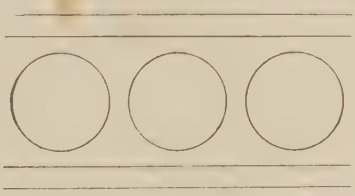
Turn the book as at first, and then lower it so as to get the top view of the models. What would you draw for the top view? (*I would draw an oblong with long sides from left to right, with a circle in the centre having a diameter equal to the short diameter of the oblong.*)

Drawing-Book, Exercise XVI. — Drawing the Three Views.

Observation Exercise for Pupils. — What are you to do upon this page? What is the illustration in the corner of the page? Place your models so that they will appear like the picture in the Drawing-Book. What will the drawing which you are to make show? (*It will show three views of the models.*) What does the picture show? (*It shows the appearance of the models below the eye.*)

Practice for Exercise XVI.

Practice. — Quadrisect the left edge of the page. Half an inch above the upper point of quadrisection place a point. Half an inch below the lowest point of quadrisection place another point. Half an inch to the right of each of the two upper and two lower points begin to practice movement for a horizontal, and draw a line to within half an inch of the right side of the page. Trisect the second horizontal. Imagine verticals from the points of trisection to the second horizontal. Consider the spaces between the imaginary verticals, and in each draw a circle large enough to look well between the horizontals, practicing movement first.



Directions. — A horizontal is given at the right for the base of the front view of the models. Bisect it, and to this point of bisection draw an indefinite vertical as a centre line. Draw the front view of the models. At the left draw the left-side view. Obtain the height of the two models by movement from the front view and draw light horizontals. Add the verticals necessary for the side view and draw the circle above the square. A quarter of an inch above the front view draw the top view, obtaining its width from left to right by movement up from the front view.

EXERCISE XVII. — Drinking-Cup on a Book. — Appearance below the Eye.

MODELS: *Drinking-Cup made by Pupils and Book.*

OBJECT. To study and draw the appearance of rectangular and conic objects.

Review. — An exercise is here given to review the work in Representation. For that purpose, a group consisting of a cylindric and a rectangular object was desired. The illustrations on the page of the Drawing-Book are not to be considered as in any way belonging to each other, the picture of the book being much smaller in proportion to its real size than the picture of the cup. They are given simply as suggestions of the objects that are to be used.

The Objects. — All teachers have felt the difficulties of providing suitable objects for groups. The objects for the very simple group here proposed are within the reach of every pupil. The book chosen should be the thickest book possessed by the pupil, and upon it should be placed the paper model of the drinking-cup. Each pupil should work from a group placed upon the desk next in front; see page 48, and the group should be so placed that it will not be either at the left or right, but directly in front of the pupil who is to study it. The apparent foreshortening of the horizontal face and convergence of the left and right edges will be well brought out by means of the drinking-cup. The relative appearance of width from back to front of the cup and of the book should be carefully considered. Should any pupil succeed in completing the drawing well before the time for the close of the exercise, they might try to make sketches of the group.

Selection of the Book. — The thickest book should be chosen, because the proportion of a thick book to its other dimensions is more pleasing than that of a thin book. Other characteristics should also be considered in the selection.

No artist would think of making a picture of books fresh from the bindery. It is true, they then show the skill and care with which they have been made to greater perfection than they can ever do after they have been used; but, nevertheless, they would not be beautiful in a picture. Why is a worn book more beautiful? The hardness of the edges is worn off, the outline is broken a little, the possible crudeness of color is softened: all this adds to the agreeable effect. But still further, a new book is devoid of associations; a book that is worn brings to us a sentiment (many times not consciously realized) that others have read it and

enjoyed its thought. It awakens in us a recognition of the humanity that surrounds us ; it seems to us in some way a friend. Lead the pupils to this feeling, that they may express it in their drawing. Make every lesson in drawing a lesson in expression. The drawing of the book may be given character by making the further edges a little less distinct than the nearer ones, by an outline somewhat broken, by noting which part casts a shadow, and strengthening the edges or profiles of the parts which cast the shadows. It may be well to give pupils opportunity to do the work for this exercise by individual study, without suggestions from the teacher.

Other Groups. — Should any pupils succeed in completing the drawing well, before the time for the close of the exercise, they might try to make sketches of the group with the book turned at an angle. The waste basket may be placed on one corner of the platform, and sketched together with two edges of the platform. A water-pail may be placed on the other corner, and be similarly sketched. Pupils must, however, sit quite far from these objects, otherwise the angle will be too great; see page 48. Either of these objects might be placed on a geography in a chair. Encourage all desires of the pupils to draw. Do not endeavor to keep pupils absolutely within the limits of an exercise. After drawing an exercise, let them go out to "fresh fields and pastures new," and learn their own powers of seeing and expressing what they see.

To be developed. — Appearance of group of objects; appreciation of character of objects; artistic rendering.

Study of Models by Pupils. — What is the form of the drinking-cup that you made? (*It is like a cone.*) Is it like a whole cone? (*It is like a truncated cone; it is like a frustum of a cone inverted.* Select the thickest book that you have, one that you have worn somewhat with study. Place the book on the back of your desks, with the back toward you. On the centre of the book place the cup. Move the group so that it will serve as a model for the pupil behind you. Observe the objects on the desk right in front of you. What can you tell me of their appearance? How does the top of the cup look? How does the lower edge of the cup compare with the upper edge? How does the top face of the book appear? What is true of the side edges of the book? (*They are parallel, horizontal, and receding edges.*) What is true of their appearance? (*They appear to converge.*)

Drawing-Book, Exercise XVII. — Drawing the Appearance of a Conic and a Rectangular Object.

Observation Exercises for Pupils. — About how large do you think the book is? Tell me what you judge to be its actual dimensions. How high do you think the

cup is? Could you draw these full size upon your page? What must you consider in making a drawing? (*We must consider the size of the page upon which we have to draw, and we should make the drawing of suitable size for the space.*) Are the edges or profiles broken or bent? Remember this in your drawing.

Directions. — Draw a light, indefinite vertical through the centre of the page. Determine the height that it will be well to make your drawing. Observe the models on the desk in front of you. Determine by measurement on your pencil the proportion of the width to the height of the group. Indicate the space that the drawing is to occupy on the page by short, light, horizontal and vertical lines, making the space proportionate to the group. Draw the back of the book. Study the top face of the book as to the apparent convergence of its sides. Determine by measurement on the pencil the proportionate width from back to front of the top face of the book. Study this in relation to the appearance of the top of the cup as well as in proportion to the width from left to right. Determine the height and place of the cup and the proportion of its width to its height. Draw the top face of the book; draw the cup. Erase construction lines, and finish the drawing in soft, broad lines. Draw a table line.

EXERCISE XVIII. — Natural Growth. — From Nature.

Each pupil should bring a branch of leaves.

OBJECT. To study plant-form and growth from a natural branch.

Nature. — For the last exercise in the book, we turn to Nature for inspiration in the production of the beautiful. It is too often forgotten that Art in form and color is the interpretation of the highest truth of Nature as expressed in the beauty of her laws of structure and of life. Study a simple branch or spray of leaves, and it will reveal wonderful laws of growth and strength. The branch grows upward, the leaves shoot forth sometimes alternate, sometimes in a rhythmic whorl. The tangential union of each leaf with the branch or stem, and the decrease of the stem above each succeeding leaf, must be noted. The curve of the midrib of each leaf is always continuous with the curve or inclination of the branch. Unity of growth is always preserved.

Appearance of the Leaves. — If you hold a branch naturally, you will see that some of the leaves turn back, some forward, some to the left and some to the right; some upward, some downward, governed by what Ruskin calls the law of deflection, falling gradually back from the uppermost one, "the gentle law of respect and room for each other." He says: "And in the arrangement of these concessions, there is an exquisite sensibility among the leaves. They do not grow each to his own liking till they run against one another, and then turn back sulkily, but by a watchful instinct far apart, they anticipate their companions' courses as ships at sea, and in every new unfolding of their edged tissue, guide themselves by the sense of each others' remote presence, and by a watchful penetration of leafy purpose in the far future. . . . But the leaf, full of fears and affections, shrinks and seeks as it obeys. Not thrust, but awed into its retiring; not dragged, but won to its advance; not bent aside, as by a bridle, into new courses of growth, but persuaded and converted through tender continuance of voluntary change." *

It is this manifold change in direction with the play of sunlight and shadow that contributes so largely to the beauty of trees or a mass of foliage.

> "Amid the leaves' green mass, a sunny play
> Of flash and shadows stirs like inward life."

* Ruskin has given most careful study to Leaf Beauty, — Modern Painters, Volume V., Part VI.

A leaf will very seldom be seen absolutely facing; each will appear more or less foreshortened. This difference in appearance must be carefully studied and carefully expressed. Very little attention should be given to the veins of the leaves or to the notches on the margins. Put the spray or branch at quite a distance from you, so that you can get the effect of it as a whole; you do not see the veins, you do not see the notches in the margin, but you can see that the light falls upon one side of the leaf or stem, and that the side opposite the light is darker than the side toward the light, and also that some leaves and parts of leaves are nearer than others, and that the farther ones give the effect of distance; you can see the varying relations of the leaves to the whole. These are the things which go to make the beautiful effect of a spray or branch. The side upon which the light falls may be expressed by a lighter outline, and the side away from the light by a stronger outline; the nearer parts may be expressed by a more definite outline, and the farther parts by a more vague outline, and a few parts which appear very prominently may be accentuated by one or two strong touches. These are the things that should be drawn, but before they are drawn they must be seen. Every pupil should have a branch that he may himself see.

The drawing of the spray should be the crowning of the work in the book. Try then to have the pupils see, not the details but the greater elements of form, position, and relation that make the beauty of the whole. Let them try to make each leaf grow from the stalk, each leaf show life in its spreading shape, the stem taper as it gives off leaf after leaf, and the terminal leaves shoot up, ready to expand. This may seem a great deal to look for with children at this stage, but if you can lead them into the spirit of the growing branch, they will find a way to express it.

To be developed. — Love of nature; general effect of spray; light, shade, distance; varying outline.

Study of a Natural Branch by Pupils. — Notice the general character of your branch; is it sturdy, showing vigorous growth, or is it delicate? What is the general direction of the stem? Is it straight up, or straight forward? Or does it bend? Could you express its direction by one straight line, or would two or three straight lines be necessary in order to show changes in direction? Are the leaves *opposite* each other, or are they *alternate?* Notice in what direction they point.

Compare the distances between the leaves or between the pairs of leaves in various parts of the stem. Where is the distance the greatest? the least? Notice the upper end of the branch; are there two leaves at the end, or only one? Study also the terminal bud.

Stand a book on its end on the back part of your desk, and stand the branch up between the leaves of the book at the top, or the parts of the binding. Take pains to place the branch so that you have the most pleasing view. Look at the proportion of the width to the height of the whole mass. Do any of the leaves on your branch appear *foreshortened?*

Drawing-Book, Exercise XVIII. — Drawing the Branch.

Observation Exercises for Pupils. — From which side does the light fall on your natural branch? Which is the dark side of the branch? Look at the illustration in the Drawing-Book: on which side did the light fall? How is this shown in the illustration?

Notice that you cannot in your natural branch see all the edge of each leaf distinctly. This can be expressed in your drawing, by broken lines and lines of varying thickness. If your leaves are toothed, do not try to draw every tooth, — merely indicate a tooth now and then.

Directions. — Plan for a large drawing of your branch. Block in the stem by one or more straight lines. Indicate the shape of the whole mass by a few light lines. Block in the midribs of the leaves and the leaves themselves. Draw the curves of the stem and leaves over the blocking-in lines. Erase the blocking-in lines where necessary. Finish in gray lines varying in thickness, making them darker on the side away from the light.

OPTIONAL EXERCISE.

The last page in the Drawing-Book may be used for an exercise on any part of the work in the book in which the teacher may think the pupils need further practice, or it may be given to an exercise in color.

Color. — There is a growing sense that color should be made a fundamental subject of study throughout school life; first, as making the child acquainted with the world in which he lives; second, as a direct promoter of mental action; third, in its practical applications. But as yet, time and means for this study are limited in the schools. In many schools which have advanced methods, color study is being pursued by means of colored papers, which furnish the types for colors, with which all color sensation may be compared, and around which color knowledge may be clustered.

The use of color in the study of form will be found of great value. Color exercises are therefore suggested for each book.

Spectrum Colors.* — A beam of light, passing through a glass prism, is refracted and decomposed, and when projected on a white screen is seen as a beautiful band of rainbow colors. This band is called the *solar spectrum.* The colors are so beautifully blended that it is hardly possible to determine where one ends and another begins. But the principal colors in the spectrum were originally spoken of as seven, — red, orange, yellow, green, blue, indigo, and violet.

Scientists are not agreed as to the primary colors in the spectrum, that is to say, as to the colors by the combinations of which the other colors of the spectrum are produced. Red, green, and violet, and also red, green, and blue are mentioned most prominently as the three primary color sensations.† In view of this disagreement, it seems better to drop the terms primary, secondary, and tertiary (except possibly in the case of pigments), and to speak of the six leading colors as red, orange, yellow, green, blue, violet, which with their intermediate colors, red orange, yellow orange, yellow green, blue green, blue violet, make up the principal spectrum colors. Red violet is added to complete the color unit.

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* The spectrum is the most perfect type of a scale of color found in nature, but there are colors in nature and in pigments which cannot be found in this spectrum.

† See Colour, an elementary Manual for Students. By A. H. Church. Published by Cassell & Co., pages 68, 76.

The six leading colors have been adopted by common consent* as expressing the divided differences of hue in the spectrum, the indigo of Newton having been dropped. Froebel gave six colored balls, and Schiller's famous color riddle begins,

> "Six sisters, from a wondrous pair,
> We take our common birth."

Color Study. — Color-lessons should not be given at random. They should have an orderly succession and should have a twofold purpose: 1. The development of the color sense; 2. The development of the power of expressing with brushes and paint, or other color material, the color-impressions made upon the brain.

In all schemes for color-lessons, the color-sense should be made the starting-point. Care should be taken that a color impression or sensation should *always* precede the *name* of the color. To this end, exercises in matching colors of objects should be given before color-names are given.

The Names of Colors. — The colored objects, whether colored cards, paper, worsted, or any other material, from which ideas of hues, and hence color-names, as yellow, red, blue, orange, green, violet, purple, citrine, russet, olive, are learned, should be those which are known as standard colors, whether in normal tones, tints, or shades. The colors should be harmonious in relation to each other, and also the normal tints, and shades of any color should make a harmonious scale, without change of hue. Great care should be taken, therefore, in selecting material for these lessons.†

Hue, Tone, Tint, Shade, Scale. — Hue is the characteristic of a color that distinguishes it from any other color; as blue, red, etc.

A **tone** is any state of a color as it passes from light to dark. Tones include tints, shades, and the normal tone.

A **normal tone** is that tone of a color that is considered typical of that hue; that tone of a color which most closely resembles its prototype in the solar spectrum.

A **tint** is a tone of a color lighter than the normal tone of that color.

A **shade** is a tone of a color darker than the *normal tone* of that color.

A **scale** of color is the regular transition from one color through succeeding modifications of it. The transition may be from tone to tone or from hue to hue.

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* See Rood, Von Bezold, Church.

† The Prang Colored Papers have been prepared with special reference to their use in cultivating the color-sense.

A dulled scale is made by mixing gray with all the tones of the scale. Russet, citrine, olive, browns, and grays are called dulled or broken colors.

Order of Study. — Color-training should be based on the color-perceptions of children, and should proceed from the known or recognized to the unknown. Exercises should be given in choice of colors, in perception of relation of colors, in laying the ideal color-unit, and in the use of colors.*

For this purpose, color-charts, color-tablets, and colored papers will be needed.† Twelve colors, — *red*, *red orange*, *orange*, *yellow orange*, *yellow*, *yellow green*, *green*, *blue green*, *blue*, *blue violet*, *violet*, *red violet*, are sufficient for elementary color work. As the relative amount of space occupied by each color in the spectrum is still a subject of discussion among students of color, and as the spectrum gives an incomplete series of color, an ideal color-unit, giving equal spaces to the colors mentioned, is presented. The first laying of the ideal color-unit from the chart by pupils should be its reproduction with color-tablets, as these can be easily moved to obtain the right arrangement. Pupils may then reproduce the chart in colored paper by cutting oblongs two inches by three quarters of an inch, and pasting them side by side in the true spectrum order. Color-names are unnecessary in the laying of the color-unit.

The six leading colors should then be studied individually. The order in which these are taken should depend on the color-perception of the pupils.

The method should be educational — color-perception first, then color-name, then color-expression. The expression of color may be by colored paper or by the brush. Colored papers can be used to great advantage in elementary work in the cutting out of representations of manufactured objects; its use in representation of natural objects is not recommended. Its use in Decoration is well known.

Practical Points in School Work. — Color Combinations. — The subject of Decoration calls especially for a knowledge of harmony of color, and there is frequently much work done outside of the books by the use of colored paper. The study of Decoration begins in the primary schools with the attempt to make pleasing arrangements with solids, tablets, and colored paper. As soon as the element of color enters, training in the harmony of color should begin.

At first, call for arrangements in the *normal* tones of the colors of the unit,

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* See "Suggestions for Instruction in Color," published by The Prang Educational Company.

† The Prang Color Chart, No. 1, color-tablets, and colored papers, can be obtained of booksellers and of The Prang Educational Company. These color materials have been prepared with great accuracy for this special purpose. Papers of inferior colors, or of colors not prepared with relation to each other, should not be used.

only *one* color to be used in any one arrangement; then for arrangements in tints, only *one* tint to be used in any one arrangement; then for arrangements in shades, only *one* shade to be used in any one arrangement.

Later, when combinations are made, let them be —

(1) Of two tints of the same color.
(1) Of two shades " " "
(1) Of two tones " " "
(2) Of three tones of the same color.

Do not call at this time for combinations of any of the leading colors.

If an object is represented by colored papers, do not allow any combination of two colors that would not be pleasing and suitable in the object.

If these rules are followed, the children will receive an unconscious training in the harmony of scale.

These combinations will furnish sufficient variety in color for a considerable school period. The use of colored papers in Decoration should always be closely connected with beauty of form and arrangement. The cutting of historic figures, such as the quatrefoils and crosses of Book I., the square-leaved quatrefoil and the shield of Book II., the rosette and Saracenic ornament of Book III., the fleur-de-lis of Book V., are especially recommended. The modification of units and their use in arrangements can be especially well carried out by cutting. The rosettes from flower forms furnish beautiful units for use singly or in borders and surface coverings.*

The combination, in a harmonious way, of colors that are separated in the spectrum will be a further development of harmony. It should be accompanied by a study of the effect of juxtaposition of colors, of analogy and contrast of colors, of warm and cool colors, of advancing and receding colors, and of color values. These should be left for more advanced study.

Color Values. — The various colors have not equal value; that is to say two colors may be used in equal amounts, but the impression made by one will be stronger than that made by the other. The value of yellow is greater than that of red, and the value of red is greater than that of blue. The values of yellow, red, and blue have been estimated as in about the proportion of 3, 5, and 8. In any composition containing the three colors, they should be used in about these proportions, unless a result having a dominant color is desired. Observations of the values of the different colors can be made from the color chart.

Colors Needed. — In choosing colored papers for use in the schoolroom, be careful first to get *standard* colors of the normal tones of the six leading

* An adaptation of this work to a sequential development of the color-sense will be found in the "Suggestions for Instruction in Color."

colors; if you can, add to these tints and shades of the various colors, so that scales of colors can be made. The intermediate colors of the unit and broken colors, such as russet, citrine, olive, with their tints and shades, also browns and grays, with their tints and shades, may be added. Paper foldings in brown or gray are especially pleasing.

Paints. — While the children are receiving color-sensations, and learning color-names by the study of color-charts, tablets, paper, and other colored objects, they can also begin to produce color-effects by the use of paints.

Beginning with yellow and red, they can learn, by mixing colors, the results produced. In pigments, yellow, red, and blue are called the *primary* colors.

YELLOW and RED, mixed, make ORANGE.
YELLOW and BLUE, " " GREEN.
RED and BLUE, " " VIOLET.

Orange, green, and violet are called secondary pigment colors, because they can be made by mixing the three primaries.

Secondaries.

ORANGE and GREEN } make CITRINE or ORANGE-GREEN, named the yellow tertiary, as it contains red, blue, and a double portion of yellow.

ORANGE and VIOLET } make RUSSET or ORANGE-VIOLET, named the red tertiary, as it contains yellow, blue, and a double portion of red.

VIOLET and GREEN } make OLIVE or VIOLET-GREEN, named the blue tertiary, as it contains yellow, red, and a double portion of blue.

There is an infinite variety of colors compounded from those mentioned, of which some are named and some unnamed. These must be left for more advanced study.

The three primaries mixed in varying quantities produce russet, citrine, olive, and browns and grays.

In mixing colors which require red, use carmine or lake; vermilion is not a good mixing color.

The Use of Water-Colors. — With a brush full of clean water obtain the full strength of color from the cake, and then transfer it to the spaces in the cover of the box as to a palette. Add color or water as strength or delicacy of tint is required.

Rarely mix more than three colors; and do the mixing upon the palette, and not upon the cakes. This is the best practice at first, though after obtaining a good knowledge of color, and skill in handling, it is sometimes better to work directly from the cake, mixing in the brush.

The Use of Brushes. — Be careful to use clean water, that is, water not charged with much color by previous mixing; and always put the brushes and box away quite clean.

A hollow sponge held in the left hand is useful to remove superfluous color from the brush, thus keeping the water clean.

Do not leave brushes in the water or put them in the mouth. When ready to put the brush away, wash it thoroughly in clean water, and give it a quick shake; this removes the water, while bringing the brush to a point and preserving its shape.

Working in Water-Color. — Do not let the surface of the paper lie flat, but slope the lower part toward you. Work from the left to the right, and from the top downward.

Keep the brush full of wet color, and work generally with the side of the brush, using the point only for lines. Surplus color can be removed, if taken up quickly, by using a nearly dry brush, blotting-paper, or a soft rag.

Flat Wash. — This term is used to indicate the laying of color evenly over a surface with a brush. This is one of the first exercises in water-color, and should be carried out in a definite space, so that ability to work clearly to a certain outline may be acquired. A vertical oblong is well adapted to practice in washes.

Decorative figures, borders, rosettes, and surface coverings may also be carried out in flat washes.

Graded Wash. — This term is used to indicate a wash laid in even gradation from a full or normal tone to a very pale tint or to white, or from dark to light. This should also be laid in a definite space. Graded washes may be made in all the different colors. By this means, much facility in handling as well as in mixing colors to produce certain color-effects can be obtained.

Special Work for Book V. — Color-training should aim first at the recognition and appreciation of color types as standards, then at the expression of those types by colored papers and by the brush. At the same time that color training is progressing regularly and sequentially from the types of color, every opportunity should be given for the freest possible use of the brush in color expression. The colors to be used with Book V. are the intermediate colors and their tones. Assortment E of Prang's Standard Colored Papers furnishes these colors.

FORM STUDY AND DRAWING IN OTHER STUDIES.

The work in Form Study and Drawing will produce comparatively small results unless teachers recognize its close relation to everything about us, and hence the use that can be made of it in all the elementary as well as many of the higher studies. The pupils should be constantly observing form, and as constantly expressing it through drawing. The teacher's work at this stage should be so laid out that Form Study and Drawing will be constituent parts of all school work, enlivening and enriching it, whether Number, Geography, Language, Science, History, or Manual Training. Pupils need no urging to do illustrative work ; they need only permission and encouragement. If such work is arranged so as to employ what they have learned in their regular lessons in Form Study and Drawing, the regular instruction will help the free use of drawing in other work, and the free drawing will help the regular instruction.

It is almost universally believed at the present day that education should begin with the concrete and lead toward the abstract. In order to begin with the concrete, the instruction must begin with things which are not only visible, but also actually tangible, to the child. Such objects must be kept within his reach until he has formed fair concepts of them. In the mean time every opportunity must be given him to express those concepts, modeling being the most available means. Drawing comes next as a ready means of expression, which is also a step toward the abstract. Drawing, as the expression of ideas of things, should be used therefore constantly.

Many teachers are unaware of the great use that may be made of drawing in connection with other studies. A few suggestive thoughts are given here, and others will be found throughout this Manual. It is hoped that these simple indications of lines of work will prove helpful to teachers. Detailed instruction will be found in manuals now in preparation on Form Study and Drawing in connection with other Studies.

Number. — Objects are used to develop ideas of number. Later, the pupils try to express the different combinations in Number through examples of their own, which must be spoken or written. If these examples can be illustrated, the expression is less abstract, and hence more real and impressive to the child, than if merely written. If the teacher will simply begin this, the pleasure of the children in this mode of expression will be so great that no further stimulus will be needed. This work should be carried on along the general lines of

development in Form Study, as there can be no real drawing without a form-idea beneath it.

If teachers will give pupils opportunities to *invent* and work out some illustrated exercises in Number, they will be surprised to see how the thoughts of the pupil are quickened. These exercises should be in close connection with the work in Drawing, and they will then act for good both on the lessons in Drawing and on those in Number. Thus the child will grow.

Geography. — There is no subject more intimately connected with form than Geography. It deals with form from its very nature, as it is the study of the surface of the earth, with all its diversities. All means of form-expression are therefore valuable and necessary adjuncts in the study of Geography. Clay and sand modeling, color, and drawing are important means in developing geographic ideas. They appeal directly to the child, and if this work for geographical purposes is made consonant with the regular work in Form Study and Drawing, it will prove very fruitful in results. The structure of the earth and its various conformations, the causes of day and night, the zones, the seasons, and vegetation will by these means become real, and not mere words.

The value of drawing, in connection with Geography, has long been recognized through map-drawing; through Colonel Parker's work at Quincy, and later at Cook County Normal School, and by the work of Charles F. King, Alexander E. Frye, and others, sand-modeling has now become well known as a means of acquainting children with the physical features of the earth. Colonel Parker also makes a strong plea for drawing these physical features. He says, "*Draw, draw, and keep on drawing.*"

Manual Training. — Both educators and practical men are now seeking the introduction of manual training into regular school work. Such training will, however, fall short of the desired results, both educational and practical, unless pursued in connection with regular systematic, thoughtful work in Form Study and Drawing, as Form is the basis of all work in manual training. Beautiful form as well as good workmanship should be sought in all work in manual training. To some, manual training concerns only the actual processes of construction, with the attendant thought and necessary skill. This should not be so; every lesson in manual training should be a lesson leading toward beauty of form and also to harmony of color where color is used.

Language. — Language-lessons should be both oral and written. They should at first concern things most apparent to the senses, gradually leading to imaginative work and more abstract thought. The materials for Form Study — the solids, tablets, decorative figures, and arrangements — present the most

admirable material for developing language. This development should begin with the pupil's observation and description of his own *action* with the models (as being the most real to him), then of the action of another; observation and description of things, — models, and objects should follow; then figures, then arrangements. Pupils should be encouraged to illustrate their written work whenever it is possible. *Complete sentences* should be required in oral as well as in written language.

Throughout the regular form and drawing work, as laid out in Drawing-Book V. and this Manual, teachers should continue to give pupils practice in the use of terms and names learned in the previous form study, as well as in the use of those given below, always requiring complete sentences.

Names of Models, Objects, and Details.

CONE: frustum.
TRIANGLE: isosceles, scalene, right-angled, acute-angled, obtuse-angled.
SPIRAL: equable.

Terms of Construction.

FACTS: foreshortening.
LINES: working, centre.

Terms of Representation.

APPEARANCE: foreshortened.

Terms of Decoration.

HISTORIC ORNAMENT: fleur-de-lis.
MOTIVE: geometric, historic, natural.

BOOK VI.

CONSTRUCTION.	SOLIDS: Cube, Cylinder, Square Pyramid, Square and Equilateral Triangular Prisms, Square Plinth.
Facts of Form.	OBJECTS: Writing Desk, Oblong Block.
	MAKING: Square Pyramid, Square Plinth.
REPRESENTATION.	CYLINDER, SQUARE PRISM, CUBE, SQUARE PLINTH.
Appearance of Form.	BOOKS, CYLINDRIC AND SPHERIC OBJECTS.
	NATURAL SPRAY OR BRANCH.
	COMPOSITION: Group of Objects.
DECORATION.	HISTORIC ORNAMENT: Spiral Border, Fleur-de-lis, Gothic Leaf.
Ornamentation of Form.	NATURAL GROWTH: Spray or Branch.
	DECORATIVE DESIGN: Modification of Units, Borders.

SUGGESTIONS TO TEACHERS

FOR

THE USE OF THE MANUAL.

The text for each exercise is divided into three parts, and each part has its special purpose. For the purpose of clear distinction each part is presented in a particular size of type.

For information with regard to the subject and the special topic of the exercise, the matter in large type should be studied. It will be noted that at the close of that part of the text, the special points to be developed with the class are given.

For suggestive methods of developing in the minds of the pupils the ideas of the exercise, the matter in smaller type headed "Study of Models by Pupils" and "Observation Exercise by Pupils" should be studied.

For definite statements as to the drawing to be done, the matter headed "Practice" and "Direction" should be studied.

It is earnestly hoped that teachers will not look upon the manual text either in its Suggestions or its Directions as something to be rigidly followed, but that they will strive to learn and apply the method and spirit of the work in the instruction of their classes. The attention of teachers is especially called to pages 3, 4, and 36, regarding the method and spirit of this work.

Note. — As pupils now receive in the first two years of school good instruction in Form-Study and Drawing, guide points and some illustrative diagrams necessary in the early edition of Drawing-Books I. to VI. are omitted in the later edition. It will be necessary, therefore, for teachers to make the slight adaptation in the instructions in the Manuals for the various exercises which is needed to meet the changed conditions. The drill exercises and practice pages, given in the Manuals as preceding the regular exercises, are to be drawn upon practice paper by pupils using the later edition.

INTRODUCTION.

It is desirable to have manifestly sequential work in Art Education. The work of any class should be an unfolding of the work of the preceding class, and should also be presented so that the work of the succeeding class may grow from it simply and directly.

Any particular Drawing-book should therefore be considered as only a part of a great whole. Teachers should become acquainted not only with the nature of the special book to be used, but also, and above all, with the purpose and spirit of the whole course, as well as with the place which the book to be used holds in the course. The study of pages iii–v, viii–xiii, 2–13 of this Manual as well as of the various Drawing-books, in their relation to each other, will be very helpful in this respect.

The Three Subject Divisions of Form Study and Drawing.

The study of Form and Drawing includes three distinct yet correlated subjects: —

CONSTRUCTION, the science and art of making diagrams or working drawings, which give the facts of objects, and from which objects may be constructed.

REPRESENTATION, the science and art of delineating or representing objects as they appear to the eye.

DECORATION, the science and art of producing beauty in ornament.

In Books I. and II. the exercises were planned with special reference to Construction, Representation, and Decoration, although the subjects were not mentioned. In Book III. and succeeding books the exercises are designated as belonging respectively to Construction, Representation, or Decoration, and the exercises in the latter part of each book are devoted to a review of the three subjects. The instruction in the Manuals is arranged accordingly.

Care should be taken to have the nature of these three subjects clearly developed in the minds of the pupils; and frequent opportunity should be taken to recall and impress them. Instruction in the three subjects should be as nearly parallel as possible; it would be found a great disadvantage to pursue one of them for six months at a time to the exclusion of the other two.

Plan of the Manuals.

In preparing the Manual Text for the Drawing-Books of The Prang Complete Course, the endeavor has been to meet all conditions.

In many cases where these books are used, the regular teachers have been prepared for the work by training and experience, and the pupils have received instruction in Form Study and Drawing according to the Primary Manual called "The Use of Models," and according to the books or method of "The Shorter Course." In many other cases, the regular teachers who are called on to teach these books have had no opportunity to become acquainted with the method or the subject-matter of the work of "The Use of Models," or of "The Shorter Course." Again, the children may not have had previous instruction, or may have received it only to a very limited extent.

The text for these Manuals has therefore been prepared with a view to meeting the needs of both teachers and pupils who have not had previous practice or training. The text under each exercise consists of two parts, the first part relating to the subject-matter necessary for the information of the teacher; the second part relating to the method of developing these ideas in the minds of the children. The exercises given for "Study of the Model" and for "Observation by Pupils" are given as suggestions. It is expected that teachers will *supplement* and *vary* this study by their own skill and tact and through their knowledge of child-nature. If the pupils are beginners in the work, the teacher must be careful to lead them to careful observation at each step. If pupils have been already prepared in the work, the earlier exercises in the Drawing-Books may be treated as review exercises by the teacher.

Method.

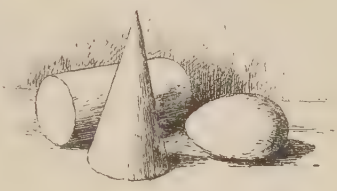
The method of the teacher should always be to lead the pupils to discover and to express for themselves all that they can about the form to be studied. Thus they will become both receptive and expressive. Each pupil should have a model, so that each one can study and discover by touch as well as by sight. Lead the pupils to discover and recognize the leading characteristics of a form or of a detail before giving the name. Do not tell the pupils what they can find out; direct their observations, thoughts, and expressions, by skilful questions and exercises; remember also that drawing, as well as language, is a means of expression. Do not give a question that will lead a pupil to repeat what you have said, but give questions that will lead to thought on the part of the pupil. Be careful to obtain a complete sentence as an answer to any question.

Review of Models previously studied.

The models of type forms given for study in Books I. to IV. are the sphere, cube, and cylinder, the hemisphere, square and right-angled triangular prisms, the ellipsoid, ovoid, and equilateral triangular prisms. For review of these models, see pages 4–13.

The characteristics of the different models are given there quite fully, and those models introduced in Book V. are given below, so that all points, signification, use of terms, etc., may be quite clear in the mind of the teacher before beginning the work of this book. It will be well to have the pupils review previous work in a general way. The review with the pupils can be carried on rapidly, if the teacher is thoroughly prepared.

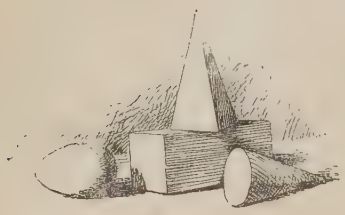
The Cone. — The cone resembles the cylinder in diameter and in altitude and the top and bottom views of both solids (when vertical) are circular in outline. But the top view of the cone differs from the top view of the cylinder because the vertex of the cone must be expressed. This is shown by a point in the centre of the circle. The front view of the cone is an isosceles triangle. The cone resembles the ovoid in action.



The cone is frequently found in nature, — in volcanoes, in mountain peaks; in many roots, seed-vessels, etc.; in leaf and flower buds. Animals and uncivilized peoples build in the form of the cone. Some birds build conical nests. The early lake dwellers made conical roofs to their curious houses, and men of to-day combine the cylinder and cone in buildings and in towers. Many shells — the shelter provided by Nature for some of her humblest children — resemble the cone.

The "horn," so often mentioned in the Bible, the "horn of plenty," or cornucopia, and the bon-bon receptacle of to-day, all resemble the cone. The cone has two faces, one plane and one curved. The plane face is circular, like the ends of the cylinder, and is called the base of the cone, being the part upon which it rests when the model is in a normal position. The curved face tapers to a point called the *vertex*. The axis of a cone is a straight line passing from the vertex to the centre of the base. In a *right* cone the axis is perpendicular to the base; in an *oblique* cone the axis is oblique to the base. The cone varies in proportion as the relative heights of the axis and the diameter of the base change. They may be equal; the axis may be less than the diameter of the base; or, the diameter may be less than the axis. Cones of the most pleasing proportion are those in which the latter conditions prevail. The wooden model is in the proportion of 2 to 1. The cone is a beautiful form; the curves resulting from its sections are the most beautiful and subtile of regular curves.

Square Pyramid. — The square pyramid resembles the square prism in altitude, diameter of base, and action. The shape of the top and bottom views of both solids, when vertical, is a square. The top view of the square pyramid, however, shows the oblique edges of the model and is a square with its diagonals. In mass, the square pyramid resembles the cone.



This solid appears in nature in crystals, and occasionally in flower buds, in the bud of the fringed gentian, for example. Civilized and partly civilized man has utilized this form in tombs, in towers, and in the roofs of houses and cupolas. The Great Pyramids of Egypt are the most remarkable examples of this kind of architecture that can be found. The square pyramid has five plane faces. Its base is square; the other four faces are triangular. The triangular faces meet at a point called the vertex. The proportion of the model may vary, as does that of the cone. The same facts are true also of the position of its axis and vertex. The square pyramid has eight straight edges. When the square pyramid is in a normal position, resting on its base, four of these are horizontal and four are oblique.

Plane Figures. — The plane figures derived from the study of these solids (see page 111) are the circle, semicircle, square, oblong, right-angled triangle, equilateral triangle, isosceles triangle, ellipse, oval. The shapes of these figures are found frequently in the faces of objects.

Fig. 1.

Fig. 2.

Fig. 3.

Illustrations are given here (for the teacher's use) of the three kinds of triangles named from the relative length of their sides: Fig. 1, an equilateral triangle, the three sides being equal: Fig. 2, an isosceles triangle, having two equal sides, named from two Greek words, meaning *equal legs;* Fig. 3, a scalene triangle, having no two of its sides equal.

Isosceles triangles, like cones, may vary in their proportions. They may be higher than wide, as high as wide, and wider than they are high. They may be acute-angled, Fig. 4, right-angled, Fig. 5, or obtuse-angled, Fig. 6, page 113.

In the study of all these figures as to shape and proportion, many details such as diameter, diagonal, axis of symmetry, and altitude are discovered.

Fig. 4.

Fig. 5.

Fig. 6.

During this study, other figures, as rhombus, rhomboid, trapezium, trapezoid, pentagon, and hexagon, may be brought out.

The glossary, at the end of this Manual, gives illustrations and descriptions of all these figures.

Drill Exercises.

Practice Paper. — It is desirable that pupils should have some practice in movement and drawing before beginning work in the Drawing-Book. For this purpose, use sheets of manila practice paper, six by nine inches.* This paper will be found useful for practice previous to many of the exercises throughout the Drawing-Book, as well as for folding. The sheets should be used on both sides for drawing. Provisions should be made for from twenty-five to thirty sheets for each pupil for use with one Drawing-Book.

Drill Exercises Necessary. — In order to draw well, two things are necessary, — a knowledge of the thing to be drawn, and skill of hand to draw. Study, then, not only the object to be drawn, but endeavor also to attain skill of hand through repeated practice. See pages 13–16, for suggestions with regard to Drill Exercises, Books, and Pencils, Pencil-holding, Movement for Circles, Quality of Line, and Length of Exercise.

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* The paper is put up in packages of one hundred sheets, and may be obtained of booksellers and of The Prang Educational Company.

Order of Class Work.

I. Form Study by Pupils.
II. Position of Book, of Class.
III. Pencil-holding.
IV. Drawing of Construction Lines. — Class Exercise.
V. Drawing Outlines. Class or Individual Exercise.
VI. Use of Eraser.
VII. Finishing the Drawing.

Details of Work.

I. In Construction and in Representation, teachers should lead pupils to study models or objects and examples; in Decoration, to study arrangement and examples of ornament.

II. Pupils should place their books with the long edges parallel to the front of the desk, but pushed well back; they should take pencils and positions for drawing the construction lines, sitting upright.

III. They should hold their pencils long, and place them at right angles to the line to be drawn.

IV. They should draw all construction lines continuously, without stopping, and at the word of the teacher; one line being drawn, all lines parallel to that line are next drawn. Light work. No testing, no erasing.

V. The outlines desired are then drawn, either as a class exercise or each pupil moving and drawing by himself and correcting with his pencil.

VI. Pencils are then placed on the desk, the eraser is taken for the first time and used in erasing superfluous and incorrect lines.

VII. The eraser having been used, it is put aside and pencils again taken to finish the work.

There are some exercises in which all these details will not be found applicable, but they show the general plan to be pursued.

CHAPTER I.

CONSTRUCTION;

Or, Drawing as Applied in Conveying Ideas of the Facts of Objects.

Of the three subjects, **Construction, Representation,** and **Decoration,** *Construction* is the one upon which the others should be built. It deals with the facts of form, and shows the use which is made of the drawing of these facts, in the world of industry. Its importance, both educationally and practically, cannot be too strongly emphasized.

Construction is the science and art of making drawings which give the facts of objects and from which objects may be constructed. These are called working-drawings, and are necessary to guide the workman in nearly every branch of manufacture.

A general view of the subject of Construction — of geometric views, working-drawings, conventions and patterns — will be found on pages 18–24. This should be studied carefully by teachers before beginning to give the exercises in Book VI., as the principles upon which those exercises are based are all clearly stated in this general view. If these principles are understood by the teacher, there will be no difficulty in giving the exercises in the drawing-book.

Suggestions for study by pupils are given in the manual text for each exercise, as to ways of bringing out important technical points. If classes are already well prepared on this subject by previous work, many of the questions suggested can be omitted. In any case, these suggestions are not to be slavishly and literally followed; they are intended to be suggestive, not prescriptive.

The directions at the end of the manual text for each exercise should be considered in the same spirit. They are intended as guides to the teacher as to the successive steps to be taken. It is well many times for the teacher to give an exercise without suggestion or direction to the pupils, for the purpose of stimulating them to master the problem for themselves. Care should be taken, however, not to use this method in an exercise unless pupils are quite prepared for it — as otherwise, it would be like calling upon them to walk, when their physical system

was not equal to it. In this subject as in every other, the method of giving an exercise should conform to the mental power and attainments of the pupils.

Pattern Sheets.

Illustrations of the pattern sheets for Books I.–V. will be found on pages 25 and 26.

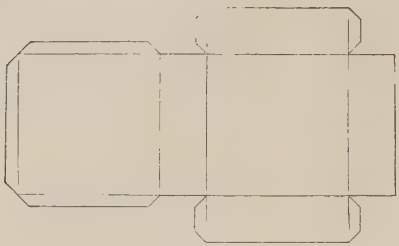


Fig. 1.

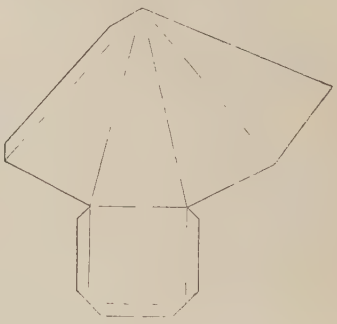
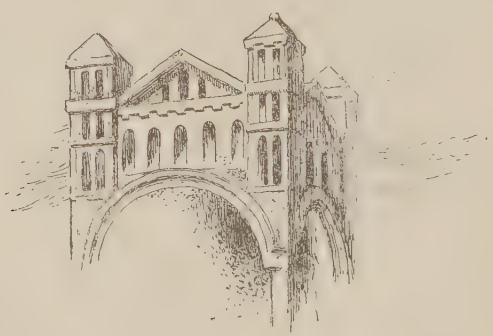


Fig. 2.

Patterns of the square plinth, Fig. 1, and the square pyramid, Fig. 2, accompany Book VI. As these patterns are of manila cardboard, the models made from them preserve their form, and can be used as models and objects in groups.



EXERCISE I. — Cylinder, Square and Equi. Tri. Prisms. — Two Views.

MODELS: *Cylinder, Square and Equi. Tri. Prisms.*

OBJECT. To give a slight review of previous work in construction; the top views of familiar solids and their names being given, to draw the front views.

Nature of the Work. — The pupil should here be led to that exercise of the imagination which will enable him to image to himself the united whole of what he studies. As a first step toward this end, endeavor to awaken thought in the minds of the pupils concerning the general characteristics of the models presented. Helpful suggestions in this direction will be found on pages 9, 10, 11. This part of the lesson should not occupy much time, just enough to concentrate the attention and interest of the pupils.

Then, appealing to the intelligence of the pupils, lead them to form their own concepts of each solid as a whole, and of the different geometric views of that whole, remembering that a geometric view shows two dimensions only.

The ***Study of Models*** given below, may then be carried out with the pupils to the extent needed, either with the models in hand or wholly from memory and imagination, according to the ability of the pupils. After this study, have pupils draw upon the board successively, and in a line with each other, the top views of the vertical cylinder, the square prism facing, the equi. tri. prism with one long edge in front, and the square prism turned at 45° (as shown in the upper line of the illustration, Exercise I., completed), beginning with an indefinite centre line (either a light full line, or a long and short dash line) for each solid, and making the centre line extend downward far enough for the front view (which is to be drawn later), and writing above the drawings, Fig. 1, Fig. 2, Fig. 3, Fig. 4. Follow the ***Suggestions for Study of Top Views,*** given below, as far as the class needs them. Remember that they are suggestions, not prescriptions. Have other pupils draw the front views of the respective solids, first drawing the **working-lines** downward (either light full lines or short dash lines) to transfer the width from the top view.

To be reviewed. — Form and proportion of models; geometric views, top and front; pencil-holding, free movement and drawing.

Suggestions for Study of the Models by Pupils. — Hold the cylinder vertical out in front of the eyes. What would you draw for the front view? for the top view? Observe the vertical square prism in the same way, first facing and then turned equally.

With an edge toward you, what would you draw for the top view? What would be the position of the square? What would you draw for the front view? How wide would the oblong be? (*As wide as the diagonal of the square is long.*) Hold the equi. tri. prism vertical with an edge toward you. What would you draw for the top view? What would be the position of the triangle? What would you draw for the front view? How wide should the oblong be?

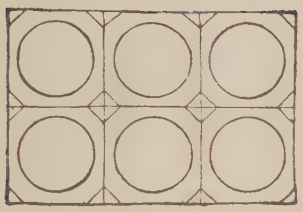
Suggestions for Study of Top and Front Views by Pupils. — Name the figures. (*Circle, square, equilateral triangle, square on its diagonals.*) These figures are top views of geometric solids, well known to you. The solids are all of the same height. Fig. 1 is the top view of a cylinder; the proportion of width to height of the cylinder is 1 to 2; what would you draw for the front view? (*An upright oblong of the proportion of* 1 *to* 2.) Fig. 2 is the top view of a square prism. What would you draw for the front view? (*The same as for the cylinder.*) Fig. 3 is the top view of an equi. tri. prism; how many vertical edges would you see in the front view? What would you draw for the front view? (*An upright oblong with a vertical line through the centre.*) Fig. 4 is the top view of a square prism, turned at an angle of 45°; how many vertical edges would you see in the front view? What would you draw for the front view?

A centre dot-and-dash line is printed for the two views of the cylinder. Centre lines are frequently made dot-and-dash lines, to distinguish them from working lines and from the details of the object.

Drill Exercise. — After the review on the blackboard, give a drill exercise for free movement and drawing with the pencil, before drawing Exercise I. This drill exercise not only gives the pupils practice for free drawing, but also for proper pencil-holding and movement. Give practice in movement with the pencil from top to bottom, and see that *each pupil* holds the pencil properly (see Fig. 2, p. xiii), — the same for movement from left to right (see Fig. 1, p. xiii), — and from corner to corner (see Figs. 3 and 4, p. xiii). Directions for the drill exercise will be found below. The completed exercise is illustrated on page 119.

Directions.* — Free movement, free drawing. Draw an oblong 6″ high by 9″ wide, using the angle given as the upper left-hand corner. Bisect the left side; from the point of bisection draw a horizontal across the oblong. Trisect the upper side; from the points of trisection draw verticals down the oblong, making six squares. In each square draw a circle about 2″ in diameter. Finish as in the illustration of the page completed, by drawing at each intersection of the dividing lines a square on its corner, having a diagonal of 1″ (the point of intersection being the centre of the square), a half square at each end of each dividing line, and a quarter square at each corner of the oblong.

* If the earlier edition of the book is used, the drill exercise may be drawn on page 1 of the Drawing Book; if the later edition is used, the drill exercise may be drawn on practice paper.



Drill Exercise.

Exercise 1, completed.

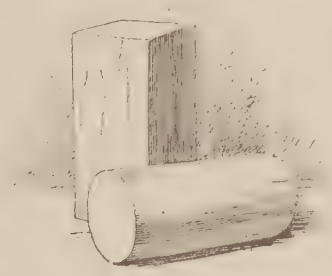
Drawing-Book, Exercise I. — Drawing Two Views.

Directions. — Consider the drawings to be placed on the page — the top and front views of four solids. Plan the placing of the top views, remembering that the top view of the square prism turned will require more space vertically and horizontally than the other top views.

As these solids are all of the same height, two horizontals across the page will serve to give an upper and a lower line for all the front views. Remember that the front views must show the proportions of the models.

Draw a vertical centre line for the two views of each solid. This line may be a long and short dash line or it may be a light full line.

Having thus laid out the page, draw the top views in even, gray lines. Draw light verticals downward from the top views to get the width of the front views and draw the front views in even gray lines.



EXERCISE II. — Square Pyramid. — Pattern.

MODELS: *Cube, Cone, Square Pyramid.*

OBJECT. To study the form of a square pyramid; to draw the pattern of a square pyramid.

Spirit of the Work. — The success of all teaching exercises depends not only on correctness as to facts and technical principles but also to a great extent on the interest aroused by the method of presentation. Pupils are always interested to know how things are made; and when they understand that the drawings of patterns and views are necessary steps in manufacture, they will be eager to work them out. Children like to see the end from the beginning fully as well as adults.

The Model. — The characteristics of the pyramid are given on page 112, to which the teacher is referred. A little time given to the form of the model will help the pupils to take up the study of the pattern with intelligence.

Patterns. — A talk on patterns and their various uses in industry and manufacture will interest the pupil. A pattern is anything cut or drawn or formed to be used as a guide in making an object and serving to determine its exact form and dimensions. Patterns are used for making almost all of the articles by which we are surrounded. Clothing, house draperies, furniture coverings, etc., all these are made from patterns. They are of two kinds, flat and solid. Flat patterns are used for making articles of cloth and other textile fabrics, as dresses, coats, curtains, bags, etc. They are also used by workers in leather and other thin materials, for cutting out work, as sheet tin or iron, for dippers, basins, etc., and for making boxes and other articles of pasteboard.

Solid patterns are used for making the molds for casting metals. Car wheels, iron ware, cannon balls, stoves, and, in fact, most of our machinery, are cast in iron from molds made from patterns. The commoner kind of glassware is made in molds, and for these molds also a pattern is needed.

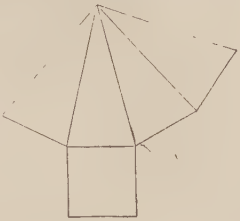
To be developed. — **Form of the model; use of name, pyramid; shape of the pattern; quality of line.**

Suggestions for Study of the Model by Pupils. — Here is a group of three models; name them if you can. Does the new model resemble more the cube or the cone? How is it like and how unlike the cone? It is called a *pyramid.* In what respect is it like a cube? (*It has a square base.*) Hence it is called a *square pyramid.* How many faces has the square pyramid? What is the shape of its faces? If you wished to draw the pattern of a square pyramid, what figures would you draw? (*A square and four isosceles triangles.*) How long are the oblique edges of this pyramid? How do they compare with the height of the pyramid? with the edges of the base?

Drawing-Book, Exercise II. — Drawing the pattern of a Square Pyramid.

Observation Exercise for Pupils. — What is Fig. 1 on the Drawing-Book page? How could you place a pyramid to look like Fig. 1? How can you place a pattern of a pyramid on the page so that it will look well? Where will you place the base?

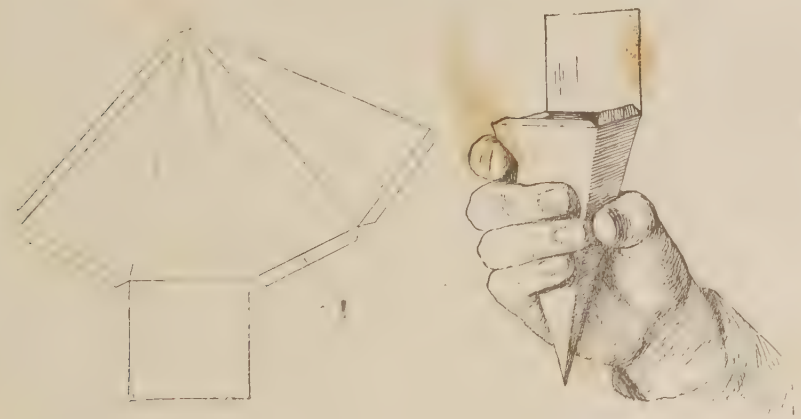
Directions. — Draw first the square base of the pyramid. Through the centre of the square draw an indefinite vertical. Upon this vertical place a point to show the vertex of the triangle to be drawn. Draw the sides of the triangle. From the vertex draw an oblique line equal in height to these sides and forming a similar angle. At the right draw two more such lines. Draw the base lines for these triangles. Correct, erase wrong lines, and finish in even, gray lines.



The Prang Pattern Sheet, No. 12. — Making a hollow Square Pyramid.

On this sheet there is a printed pattern of a square pyramid. Cut out this pattern, fold and paste to make a hollow, square pyramid. Preserve for further study.

The illustration below shows a way of arranging the laps on the pattern, so that the base may be pasted on the laps.



EXERCISE III.*—Square Pyramid facing.—Square Pyramid turned.

MODEL: *Square Pyramid.*

OBJECT. To study the form of a square pyramid; to study and to draw the facts of a square pyramid facing, and of a square pyramid turned at 45°.

Rapid Work.—This exercise is preliminary to Exercise IV. and should be carried through rapidly. Before giving it, however, read the text for Exercise IV. While careful thought should be required, a quick expression of the thought should also be encouraged. Drawing is the best means of expressing form. If pupils can show their ideas of the different views of a model or object at once by drawing, it will be better to have them do so, before expressing it by words. After this expression by drawing, questions of the nature suggested below may follow, if the drawings of the pupils show that the ideas have not been correctly apprehended.

Views of the Pyramid.—It should be carefully borne in mind that a geometric view concerns itself with the three dimensions only and not with actual lengths of all edges. In the case of the upright square pyramid, for instance whether facing or turned, the geometric views do not show the oblique edges in their true length; but the front view does show the true height of the model, which in this case is just twice the length of one edge of the base. The top view deals only with the width from left to right and the width from back to front—the oblique edges must be included within these two dimensions. See the illustration of Exercise III. completed, page 125. The front view deals only with the height of the model and the width from left to right—it does not consider at all the length of the oblique edges. The first thought in drawing geometric views should be, therefore, to get the correct proportion between the three dimensions, the oblique edges in the drawing conforming to this proportion. Pupils' drawings of geometric views should be examined with special reference to the comprehension of these points.

To be developed.—Careful thought; quick expression; three dimensions only, in geometric views; good placing; quality of line.

Suggestions for Study of the Model by Pupils.—(See page 112.) What is the name of this model? Place the pyramid upright and facing you. Look directly down on it; what do you see? (*A square.*) What else? (*A point and oblique edges.*) Where shall the point be made? (*In the centre of the square.*) From what point in the

* If the later edition of Book VI. is used, this exercise as illustrated on page 125 can be given on practice paper. The placing of the drawings should be carefully studied.

top view does it start? (*The centre.*) Where does it end? (*At a corner of the base.*) Study the whole of the top view. What should be drawn for the top view? (*A square and its diagonals.*)

What is the shape of the front view? (*An isosceles triangle.*) See pages 112 and 113. The altitude of the pyramid, that is, the distance from the vertex to the centre of the base, gives the height of the front view. Stand the model on the desk, rest a book horizontally on the vertex, and measure the vertical distance from the book to the desk. Compare this distance with the *slant-height* of the pyramid, that is, the distance from the vertex to the centre of one of the edges of the base, and also with the length of an oblique edge of a triangular face.

Study the pyramid *turned*, in the same way.

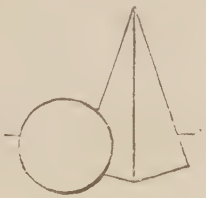
Exercise III. — Drawing two views of the Pyramid, facing and turned.

Observation Exercise. — Consider the page. What drawings are to be made? As the model studied is the same for each drawing the dimensions in each drawing should agree. What should the size of the drawing be? How should you place them on the page.

Directions. — *Pyramid facing.* A horizontal is printed for the base of the front view of the pyramid. A centre line is also printed. Fix a point on the centre line for the vertex of the front view, making the altitude of the pyramid twice its width, and draw the sides. From each end of the base, move upward nearly to the top of the page, and draw a light vertical downward to the base.

Above the front view, draw the top view of the pyramid facing, placing it so that it will not interfere with the printing.

Pyramid turned at 45°. Draw an indefinite centre line through the given point, the centre of the cross. Using the given point as centre, draw the top view, — a square on its diagonals, making the diagonals equal to the diagonals of the top view of the pyramid facing. Draw indefinite verticals, downward from the left, lower, and right corners of the top view, and draw the front view, making its height equal that of the front view of the pyramid facing.



EXERCISE IV. — Cube facing. — Cube turned. — Square Pyramid turned.

MODELS: *Cube, square pyramid.*

OBJECT. To recall the facts of a cube and a square pyramid; to draw two views of a cube and square pyramid turned at 45°.

Purpose of Constructive Drawing. — Here, again, show the connection between the constructive drawings required and actual manufacture. This may be done in various ways. Working drawings of objects or details, together with the objects manufactured from these drawings, may be borrowed from some establishment to show to pupils. A visit of the class may be made to some manufacturing industry, that the pupils may see the process of making articles from working-drawings.

The class may be supposed to belong to a manufacturing establishment. An order for fifty sets of three models each, comes to the establishment, accompanied either by one set of the three models themselves or by working-drawings of the set of models. If the models themselves are supposed to come, the teacher may call upon three pupils (the draughtsmen of the establishment) to show, by drawing geometric views on the board, what the models are. The dimension lines (see pages 19 and 20) may be added. The rest of the class (the workmen of the establishment) may then be called on to state the object to be manufactured, with its dimensions.

If there are any in the class, who by any workshop practice out of the school, or by manual training in the school, are able to make the models, a partial order may be divided among these pupils, to be executed from the drawings on the blackboard, of which these pupils may take notes. This is a suggestion for an exercise in reading working-drawings. Similar ways of making the constructive drawing a real thing to pupils will occur to teachers.

Fig. 1.

Frustum of a Pyramid. — The frustum of a square pyramid is a form of frequent occurrence. For a full description of frustum and some applications of it, see pages 42 and 50. The caution on page 42, with reference to the pronunciation of the word, should be especially noted. The pattern of an open box based on the frustum of a square pyramid is easily made. Fig. 1 shows two views of a frustum of a cone; Fig. 2, two views of a frustum of a pyramid. In the lamp, on page 125, two pyramidal frustums are seen.

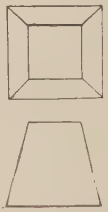


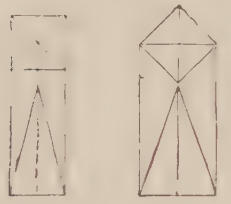
Fig. 2.

To be developed. — Use of constructive drawings; views of cube and pyramid; good placing; careful drawing; quality of line.

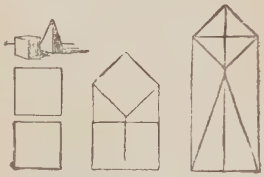
Suggestions for Study of the Models by Pupils. — (See page 21.) Recall the top and front views of a cube facing; of a square pyramid facing. How do the top views of the two models differ? Study the top and front views of the models turned.

Drawing-Book, Exercise IV. — Drawing two views of Cube and Pyramid turned

Observation Exercises. — Turn your models at angles of 45°. Did you ever see any object in which there was a cube or a pyramid turned? What would you draw for the top view of the cube turned at 45°? (*A square on its diagonals.*) Of the pyramid turned? (*The same, with its diagonals.*) How many edges are visible in the front view of the cube turned? (*Seven.*) Of the pyramid turned? (*Five.*)



Exercise III., completed.



Exercise IV., completed.

Directions. — Two views of a cube are given, to show the size of the drawings to be made.

Cube turned. A centre line and the centre of the top view are given. Follow the directions given on page 123 for the top view of the square pyramid turned. Draw light verticals down from the left, lower, and right corners, and complete the front view.

Pyramid turned. The centre of the top view is given. Draw according to directions given on page 123. Finish the top and front views in even gray lines.

EXERCISE V. — Cylinder and Square Prism Combined. — Drawing the Facts. — Three Views.

MODELS: *Cylinder, Square Prism.*

OBJECT. To study and to draw the different views of two models combined.

Illustration on the Drawing-book page. — This shows the appearance of the models combined below the eye. Although the appearance of the models is not to be drawn, a few moments may be given to its consideration. It is a good exercise to have each pupil place his models on a book at such a distance below the eye that they will appear like the illustration. If the models are held too far below the level of the eye, the top faces will appear wider from back to front, in proportion to the height, than they do in the illustration; if the models are held too near the level of the eye, the top faces will appear narrower from back to front, than they do in the illustration.

It is important that pupils should appreciate the difference between the *appearance* of an object in different positions and the *facts* as expressed by *geometric views* of the same object. If the teacher has this difference clearly in mind and presents it in a correct way for observation by pupils, there will be no confusion in their minds between the appearance of an object (the aspect which it presents to the eye) and the facts of the same object (which concern the three dimensions). A true appreciation of the difference will serve to fix each more firmly — for the study of one aspect complements the study of another aspect, and all combined give the true idea of the whole.

Combinations as wholes. — It cannot be too often said that a geometric view concerns only the three dimensions. A geometric view of a combination of models considers, first, the three dimensions of the combination as a whole. Lead the pupils to realize that in constructive drawing they are seeking to represent *the facts* of the dimensions in three directions, — how wide from back to front, how wide from left to right, how high. All details are subject to these three principal considerations. The three views of the cylinder and square prism combined should be studied in this way. The drawing of these views is shown in the illustration below. It will be well to have the views drawn quickly by pupils (models in hand or directly in view), part drawing upon the blackboard, and part on practice paper.

Placing of views. — In making any drawing, the first consideration should be its size in proportion to the space in which it is to be drawn, and its proper placing on the page. In the case of a working-drawing, these points call for more

detailed planning at the outset, than in the case of a pictorial drawing, because the working-drawing is so frequently composed of two or more views which must hold the proper relation to each other. Hence each view must be clearly apprehended before the placing of the drawing is determined. Pupils should have clearly in mind, therefore, each of the views required, before attempting to place the drawing on the page of the drawing-book. This exercise of planning the placing is a good mental discipline, requiring clear imaging.

To be developed. — Three dimensions of a combination as a whole; details of each solid; placing of views; careful drawing; quality of line.

Suggestions for Study of the Models by Pupils. — Place on a book the cylinder and square prism, arranged as in the illustration in the drawing-book. What is the proportion of the cylinder? (1 *to* 2.) Of the square prism? (1 *to* 2.) How do the two models compare in size?

Lift the book until the top of the square prism is on a level with the eye, and study the front view. What would you draw for the front view? (*An oblong, 1 to 2, with long sides from left to right, its middle half hidden by an oblong of the same size and on the same base, long sides from back to front.*)

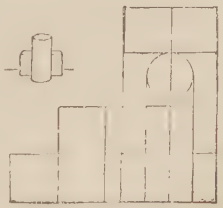
Turn the left end of the book toward you; what would you draw for the left side view of the models? (*An upright oblong, with a square of half its height touching it at the left and on a line with it at the base.*)

Turn the book as at first, and then lower it so as to get the top view of the models. What would you draw for the top view? (*An oblong with long sides from left to right, with a circle below it, touching the middle of the base of the oblong, and having a diameter equal to half the base of the oblong.*)

Drawing-Book, Exercise V. — Drawing the Three Views.

Directions.* — A horizontal is given at the right for the base of the front view of the models. *Quadrisect* it; that is, bisect it and bisect each half. On the middle half draw the front view of the cylinder, first drawing an indefinite vertical as a centre line; add that part of the square prism seen. An angle is given at the left for the left end of the base of the side view. Obtain the height of the two models by movement from the front view and draw light horizontals. Add the verticals necessary for the side view.

A quarter of an inch above the front view draw the top view, obtaining its width from left to right, by movement up from the front view. Correct, erase unnecessary lines and finish in even gray lines.



Exercise V., completed.

* If the later edition of the drawing-book is used, pupils should be led to plan the whole placing.

EXERCISE VI. — Square Plinth. — Pattern.

MODELS: *Cube, Square Prism, Square Plinth.*

OBJECT. To study the form of a square plinth; to develop and draw the pattern of a square plinth.

The Square Plinth. — This is a solid which has been only incidentally studied in previous work. A plinth (from a Greek word originally signifying a brick, a tile) is a solid whose height is its least dimension. A square plinth has sometimes been called "a slice of a cube" as a circular plinth has sometimes been called "a slice of a cylinder." The square plinth, the cube and the square prism having the height greater than the width, are all special examples of the general form, square prism. A prism is a solid having two plane polygonal faces called bases, and between these bases, as many plane side faces as the bases have sides. A square prism is a prism having square bases. Hence, it will be seen that the square plinth is a square prism having an altitude less than its width; a cube is a square prism, having an altitude equal to its width; and the square prism studied in this course (in this special case having the proportion of 1 to 2) is a square prism having an altitude greater than its width. The altitude of a plinth bears no fixed proportion to its width.

A square plinth occurs in architecture as an *abacus*, at the top of a capital (see page 150), and as the foundation of a column (see page 129), serving to distribute the weight. The form of the square plinth is seen in boxes, books, bases of statues, etc.

A solid having the oblong form of a brick is called a *plinthoid*. Thus the solid resulting from cutting the upright model square prism vertically is a plinthoid.

Spirit of the Lesson. — Endeavor to make this lesson a distinct advance in mental requirement from that in Exercise II. After a short preliminary study of the form of the square plinth, lead pupils if possible, to conceive the pattern without paper-folding. If there is difficulty in doing this, follow the suggestions given below. Lead the pupils to the planning and the placing of the drawing themselves. The definite "Directions" given are for the teacher and are not intended to be given to the pupils, unless, at some time, there would seem to be a need for a dictation exercise. Pupils can be reminded that, as a general rule, it is well in any diagramic drawing, to draw the long lines first.

To be developed. — Form of square plinth; its pattern; planning and placing; careful drawing; quality of line.

Suggestions for Study of the Models by Pupils. — Here are three models. Name the two you know. How does the square prism differ from the cube? Compare

the new model with the cube. How is it like the cube? How does it differ from the cube? What is the proportion of the square prism. (*As* 1 *to* 2.) What is the proportion of the square plinth? (*As* 3 *to* 1.) Take a strip of paper 8″ long and 3″ wide. Place the square plinth at one end of it, and fold the paper about it, creasing the edges. Unfold. What have you creased? (*Two squares and two oblongs.*) What more is needed to complete the pattern of the plinth? (*Two more oblongs.*) Where should they be placed? (*One on each side of one of the squares.*)

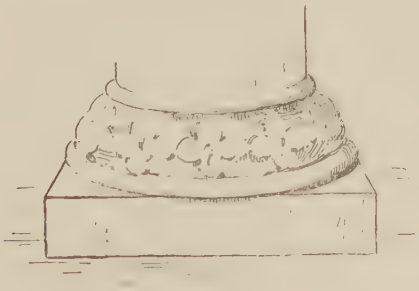
Drawing-Book, Exercise VI. — Drawing the pattern of a Square Plinth.

Observation Exercises for pupils. — What do Figs. 1 and 2 show? What would you draw for the pattern of a square plinth? Consider where it should be placed to look well upon the page.

Directions. — Decide upon the placing of the drawing, and draw two indefinite horizontals across the page, for the upper an lower sides of the square faces. Bisect the horizontals and through the points of bisection draw an indefinite vertical. At the left, draw an indefinite vertical for the left side of the square. To the left and right of the square, above and below it, mark off on the indefinite lines a distance equal to the short side of the oblong face of the plinth, and complete the four oblongs. To the left of the right oblong mark for another square, and draw the vertical necessary to complete it. Erase unnecessary lines, and finish in even, gray lines.

The Prang Pattern Sheet No. 13. — Making a hollow square plinth.

On this sheet there is a printed pattern of a square plinth. Cut out, fold, and paste to make a hollow square plinth. Preserve this for future use.



OPTIONAL EXERCISE.

According to the teacher's desire.

Construction or Representation. — Different classes develop in different ways. One class may need more work in constructive drawing, and another class may need more work in pictorial drawing. A teacher will find, therefore, occasionally a need for giving additional work in one of these subjects.

Construction. — Pupils might be asked to give, in several small drawings, the geometric views of the square plinth in different positions, — resting on its base and on its side, facing and turned. (See illustrations on page 131.) If manual training is carried on in the schools an exercise directly connected with the special work in Manual Training might be given.

Representation. — Pupils might be given opportunity to make two or more *sketches* or *studies* of rectangular objects turned.

If you go into an artist's studio you will find many studies on the walls, and many more put away in portfolios. There may be a bit of drapery in monochrome; a figure blocked in; a few rocks and trees; some very hasty color effect, done quickly so as to catch the changing color of sea and sky before it vanished. These are many of them made out-of-doors, to bring light and life into the studio work. They have rightly been called studies. An artist could not work without his studies, wherein he seriously strives for some special thought. Thought is always necessary to any good work. However easy the result may seem, study always lies back of it.

The artist's study is frequently begun by *sketches*. These are the rapid expression by drawing or color of what he sees or thinks. Later come the more serious *studies*, which find their result finally in the finished picture. Having the thought of the necessity for *studies* in art, an opportunity is occasionally given throughout the course for a study page. All the pages in a drawing-book are in a way study pages; but in some, opportunity should be given for expressing first impressions, which may be more fully developed.

Drawing from plant form is always a good exercise. A spray of leaves in two different positions forms a good subject. Pupils should not, however, take these positions at random, but should select those positions in which the spray presents the most pleasing appearance. A single leaf drawn in several positions is also a good study. The illustrations on the following pages are suggestive. The study and drawing of the appearance of a beautiful vase has great value, not only as practice in drawing the appearance of an object, but also in the cultivation of the taste.

A Page of Suggestions.

Fig. 1.

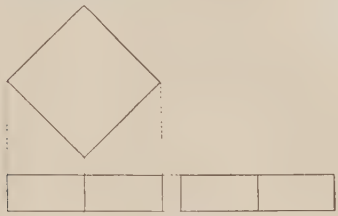


Fig. 2.

Fig. 3.

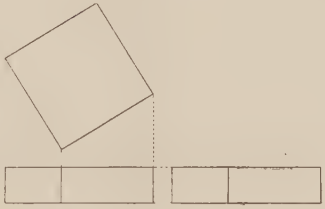


Fig. 4.

Views of Square Plinth in Different Positions.

Fig. 5.

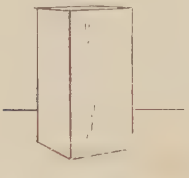


Fig. 6.

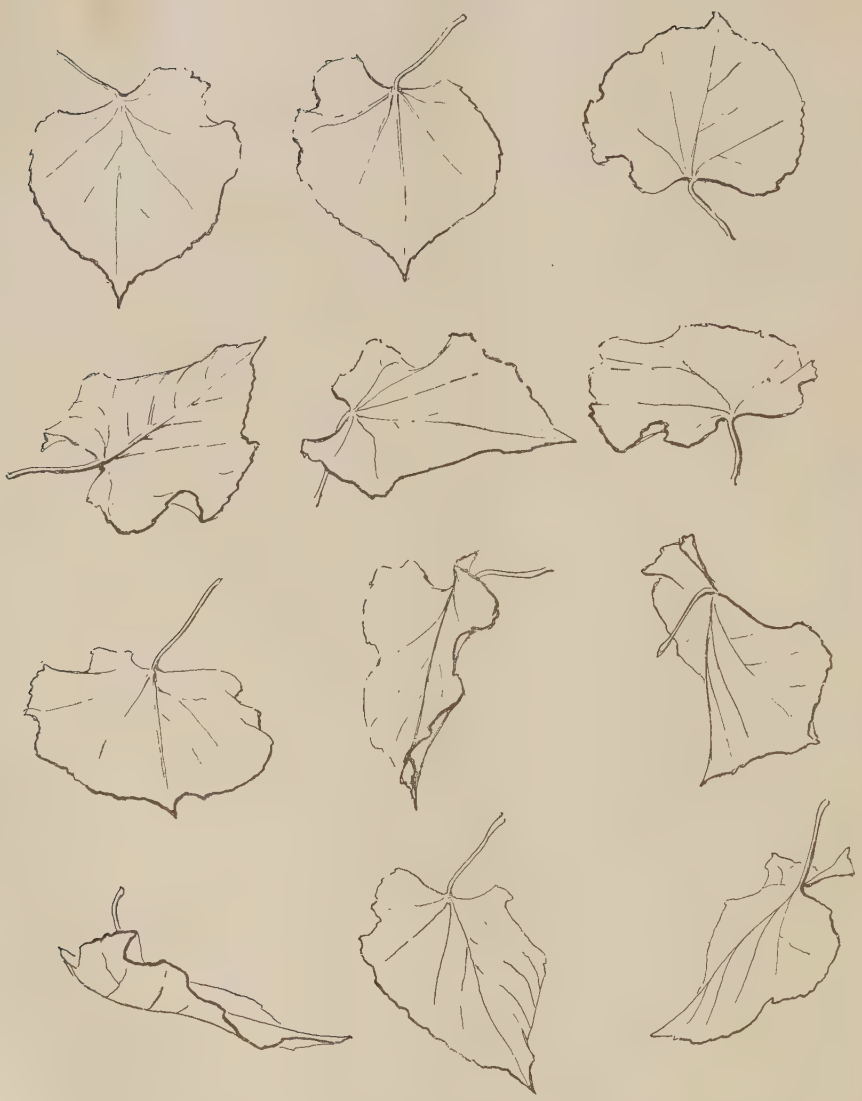
Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Appearance of Rectangular Objects Turned.



A Leaf in Different Positions.

A Spray in Different Positions.

CHAPTER II.

REPRESENTATION;

Or, Drawing as Applied in Representing the Appearance of Objects.

Representation is the science and art of delineating or representing objects as they appear to the eye. It concerns picture-making. The study of the facts of form of objects in Construction prepares the pupil for the study of the appearance of objects in Representation. Representation is the complement to Construction, and follows it legitimately.

The principles of the two subjects are, however, widely different; for Construction requires two or more *geometric* views, each from a different standpoint, while Representation requires a *picture* from a single standpoint.

Helpful suggestions on this subject, and a statement of the principles already reached in the course before Book V., will be found on pages 44–49. It will be well also to study pages 50–64, concerning the appearance of the cone, square prism, and objects resembling these solids.

Selection of Objects. — It is well to remember that even in its beginnings, this work should be pictorial art. For this purpose, select objects which are beautiful in form and pleasing in association. The many pleasant associations that we have with objects which are constant companions form a good basis for direct study. Read in connection with this thought "**Selection of the Book.**" page 92.

The selection of natural objects must be made with equal care. It is frequently said that "Nature never makes a mistake." The inference made by some from this statement is that all natural objects are beautiful. A moment's reflection will show that this is not true. In selecting natural objects, of any definite kind, for Form Study and Drawing, the guiding thought should be to choose a characteristic and beautiful example. Apples which are almost perfectly round can be found, but they cannot be considered as being the most beautiful examples, as they are not characteristic, and therefore not typical. The effort should be, not to find an apple that is like a sphere, but an apple that is most like an apple. Therefore try to have the apples, on the one hand, not too round, and, on the other hand, not unusually irregular. The apples should also have the beauty of freshness.

"There's a smile on the fruit."

The same line of thought should be given to the selection of any natural forms.

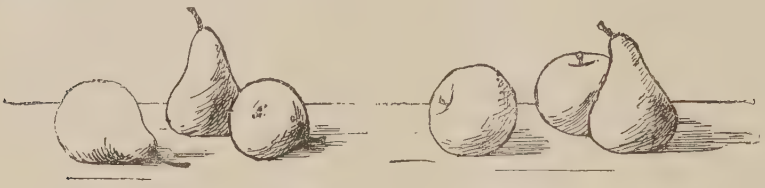
Quality of Line. — Every drawing should show a feeling for the character of the material of the object drawn. This is always seen in what is called **artistic rendering.** The wooden models are exact in form and outline; therefore, in drawing their outlines, a line even in width, while also soft and transparent, should be used. Natural objects differ from manufactured objects in substance and texture, and they have varying outlines. The outlines not only vary in direction, but they are more decided and definite in some parts than in others. This variation in direction and in definiteness is expressive of the varying forces of life and growth, and must be rendered by a similarly varying line in the drawing. A lemon being somewhat indefinite in outline, on account of the peculiar texture of the skin which holds its delicious fragrance, should be drawn with a line varying in thickness and not quite continuous. The skin of the apple is smoother; this will need a somewhat lighter line and more continuous throughout than the line for the lemon. Remember also that it is the general form which should be expressed and not the small details.

Table Line. — In order to show that an object is resting on something, and thus to give an effect of rest in the drawing, what is called a **table line** is added. This line represents the further edge of the table or shelf on which the object rests. Place an apple on a book slightly below the level of the eye and observe how high up on the outline the further edge of the book appears to be. This will help you in drawing the *table line*. In order to have the table line properly observed, the teacher must see that objects are not placed too near the further edge nor too far in front of it. In the former case, the table line will appear too low and as if the object were in danger of tumbling off; in the latter case, the table line will appear too high and as if the object were surrounded by too much space. A good general rule is to place the object so that the further edge of the table or object on which it rests will appear to be less than half way up the height of the object. The table line should always be made a little lighter than the line of the object.

A Group. — If a picture of a group is desired, it will not be satisfactory to place the objects at random and then draw them. Some thought must be given to the arrangement; for, if arranged in one way, the group may be very pleasing, while if arranged differently, the group may not be at all pleasing. If such arrangements are considered thoughtfully, it will be found that, in the one case, the simple principles of elementary composition have been regarded, and in the other they have been disregarded. It will be found, moreover, that these principles of composition are so simple and natural that children may be led to discover them.

The Arrangement of a Group. — In studying the arrangement of a group, consider, —

1. The place of the principal object.
2. The place of the secondary objects.
3. The figure made by the group on the table.
4. Partial view of some of the objects.
5. Upper line of the group.
6. **Variety** in the positions of the axes and in the faces visible.
7. **Repose** of the objects.
8. **Unity** of the group — distance between objects.



(1) Choose the principal object, and, generally, place it centrally but not exactly in the centre; (2), do not place the other objects in a straight line with the principal object; (3), try the effect of placing the objects so that if the centres of their bases were connected an irregular figure would be made; (4), place them as if they were good friends and belonged together, and (5) so that they will appear at rest. But remember (6) that the objects should not have the same positions, that is, their axes should not be all upright or all horizontal; they should not be parallel or at right angles to each other; and they should not present exactly the same faces; and (7) one of the objects should be partially hidden behind another, even if there are no more than two objects in the group. Look now (8) to see if, in the group that you have made, the objects will appear of the same height when drawn. If so, change them, for the effect will not be pleasing. By skilful questioning, the pupils can be led to these points.

It will be noticed that unity, repose, and variety are emphasized as of particular importance. They are indeed essentials in all good pictorial composition. There should be variety, but it should be subordinate to unity. A variety of things having no apparent connection with one another gives no pleasure in a picture, and distracts rather than composes. Delicate fruit grouped with rougher vegetables seems inharmonious; there is no unity. They have not enough in common, either in the purpose which they serve or in their general appearance. The arrangement is incongruous. Only the most hardy fruit should be grouped with vegetables. Where unity is lacking, repose is always lacking.

Consider also the arrangement with reference to carrying the eye into the picture. Placing one object farther back than another suggests distance into the picture, which is always pleasing, as it brings with it the feeling of freedom. If one of the objects is placed so that its axis or its leading lines tend from you, it will aid in producing the effect of distance.

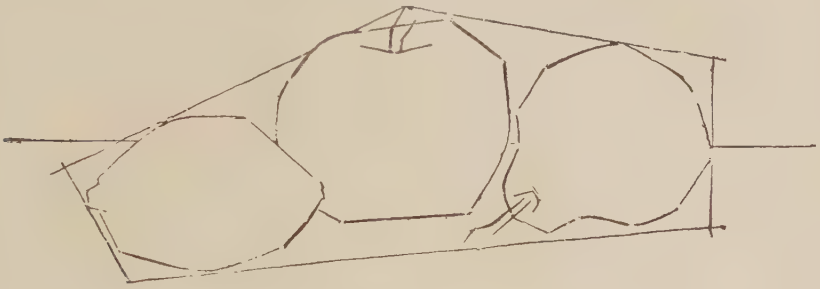


Fig. 1.

Blocking-in.—The group being arranged, it should be blocked in. There is no means of getting so quickly the general shape of a group as by blocking-in. But very few lines should be used in blocking-in, for if every change in direction should be represented by a line, the process of blocking-in would become that of studying details. Study of the whole or the mass should be the first step always. The illustrations, Figs. 1 and 2, will show how a few lines will bring out the general mass; a few more have been added to bring out each object as a whole.

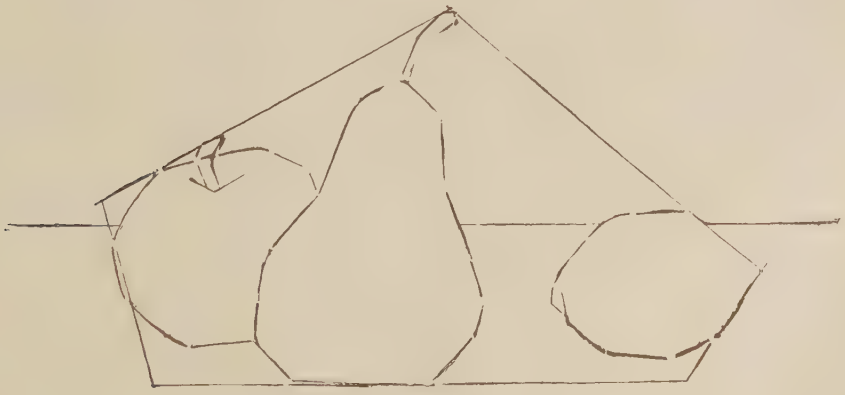


Fig. 2.

You will note that the blocking-in lines sometimes touch the outlines of the objects, sometimes cross them, and sometimes do not touch them at all. There is no rule for blocking-in which excludes any of these conditions; any of these ways may be taken which will help to express the general shape of the group.

Blocking-in has more than the immediate effect of getting the shape of the particular group to be drawn. It induces a habit of mind; it leads to study of the mass everywhere, to large views, to looking at the whole before the parts, beginning first in judgment of a single form, then of a group of forms, continuing this habit in judgment of actions, and of events.

Rendering a Group.

Rendering. — Having blocked in the group, the next thought must be how to finish it so that it may best tell its story. In completing any drawing, it is necessary to have in mind the whole thought which is to be expressed. In this case, as it is the desire to show, not *single* objects, but a group of objects, the *rendering* — that is, the quality and variety of line used — should be such as to suggest the leading ideas of a group. Therefore, it should be the aim to express the same ideas in the drawing that were specially considered in the arrangement.

The Principal Object. — It is necessary that one object should be more noticeable than others, in order to have the eye at once attracted. The principal object in a picture may not be consciously observed first, but the eye finds there a resting-place; if, on the contrary, there are two or three objects equally prominent the eye is distracted, and the attention wanders. The principal object should be rendered by drawing in such a way as to attract the eye at once. The lines should be not only the strongest in the group, but they should also be the most definite.

Secondary Objects. — One object alone is not so interesting as a group of objects. The introduction of other objects, though less important, adds the agreeable element of contrast by means of the relation of these objects to the principal object. As they are subordinate to the principal object, they should be rendered by lines not as strong and not as definite as those of the principal object.

Distance. — The effect of distance into the picture, obtained by the placing of some of the objects farther back than others, must be expressed in the rendering by making the lines for the farther objects somewhat lighter and less definite than those of the principal and nearer objects.

Light and Shade. — A little emphasis on the side of the objects opposite the light, to suggest shadow, will also add to the effect. If the light comes from the left, — as it should do in every school-room, — the shadows of the objects would be on the right side, and hence the right side should be emphasized. But

the light comes from above also, so that the lower part may also be strengthened. These dark lines suggest shadow, but they also suggest light; for there would be no shadow were it not for the light. So the touches for shadow really introduce the thought of light into the group.

Variety. — The element of variety will appear in the rendering already suggested. In addition, it must be remembered that the line should vary according to the character of the object. If the object is manufactured, the edges and profiles will be sharper and more even than those of a natural object. These qualities should be shown by an even and firm line in the one case, and by a varying line in the other.

Unity. — The effect of unity produced by the arrangement of the objects can be increased in the rendering by putting the emphasis on the principal object, and keeping the others in their proper relation.

Repose. — This is one of the highest qualities in pictorial composition, but some of its elements may be brought out even in early work. The effect of repose is produced by the proper and restful arrangement of objects. This effect will be increased in the rendering if the transitions from light to dark, from definite to indefinite, are gradual and not violent. The table-line is a very necessary, though minor, element of repose, as it gives the idea of support. The table-line should, however, be less prominent in drawing than the group.

In artistic rendering of outline, the principal and the secondary objects, the nearer and the farther objects, the light and the shade, are all made manifest by the difference in quality and emphasis of line. The principal object has the strongest emphasis, and all other objects receive less in proportion to their importance in regard to the principal object. This must be carefully borne in mind; for an eager worker often forgets the need for expressing the relation between the principal and the subordinate objects, and emphasizes equally the shade on all, ignoring values, and producing a staring, and "spotty" effect, quite different from that produced when a due regard is paid to subordination of the less important, and appreciation of the more important, parts.

EXERCISE VII. — Spheric and Conic Objects.

MODELS: *A Shallow Dish filled with Apples.*

OBJECT. To study the appearance of spheric and conic objects together; to draw their appearance.

The Models. — It will be well to review rapidly the appearance of the cylinder and cone somewhat below the eye and then pass to the study of the dish.

Observing the appearance of the dish below the eye, you will see that the top appears like an ellipse — that the lower curve appears deeper in proportion to its long diameter than the upper one. You will also see that the profiles join the curves tangentially, and that they seem to join both upper and lower ellipses a little in front of or below their long diameters. Tangential union is explained and illustrated on pages 51 and 52. This union is very beautiful, being an admirable illustration of harmony. It is therefore especially important that teachers should appreciate its value.

Placing the Models. — The appearance of an upright cone or a cylindric object remains the same, from whatever side it is seen, if the object remains on the same level and at the same distance from the eye. Two such objects for a row of pupils will be quite sufficient. The placing of objects for such an exercise is generally something of a problem. In this case, the solution is easy. See pages 56, 57.

Appearances Differ according to Distance. — It must be remembered that an object appears differently according to the distance from the eye and the angle at which it is viewed. The appearance of the dish to pupils will be according to their distance from it — those farther away will see it at a less angle than those nearer. Those farther away will also see fewer details than those nearer. If the drawings of the various rows should be all alike, it would show that some pupils did not draw just what they saw. It is quite likely also that the dishes may not be alike in form. Very probably they may not have as strongly defined edges as those in the Drawing-Book. Perhaps a bit may be broken out of some of the dishes; in that case, each pupil to whom the break is visible will have his own individual view of the break, differing from that of every other pupil. In drawing any defect, it must be only slightly indicated, else it may seem the principal thing delineated, and thus draw attention from the more important whole.

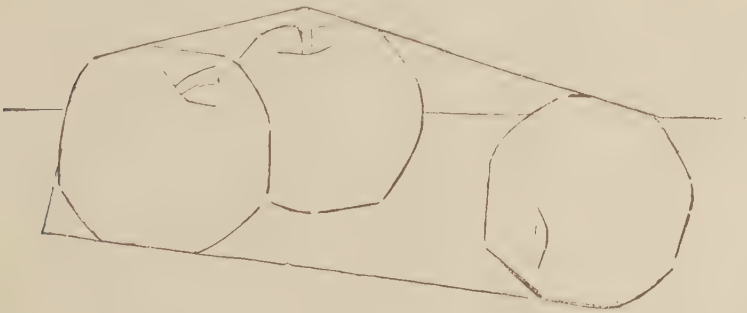
To be developed. — Ability to see the whole before the parts; blocking-in; careful drawing; artistic rendering.

Suggestions for Study of the Models by Pupils. — What is the form of this dish? Place it slightly below the eye. What is the appearance of the top? How much of its lower edge can you see? How does this appear? If you could see the the whole lower edge how would it appear as compared with the appearance of the upper edge? How do the outlines of the sides of the dish seem to touch these ellipses? (*They touch tangentially.*) What is the general form of these apples? When placed in the dish, what part of it do they hide from you? Pile apples in the dish, so that it will look full but not crowded. See that some apples have the stem toward you, others their blossom end, and that others are in still different positions, that variety may be obtained.

Drawing-Book, Exercise VII. — Drawing a Dish of Apples.

Observation Exercises for Pupils. — What is the general proportion of the dish of apples? Obtain this by measurement upon the pencil, as suggested on pages 45, 46. With the aid of the pencil, study the general shape of the outlines of the group, that is, its blocking-in lines. The illustration below shows the blocking-in of a group of apples. For further suggestions the teacher may refer to pages 133–138.

Directions. — Decide upon the placing of the drawing upon the page so that it will look well. Draw a light vertical through the centre of the page. Indicate the proportion and general outline of the group and objects by blocking-in lines. Practice the movement and draw the ellipses with one sweep. Draw the dish, and the apples, erasing unnecessary lines, and finishing the whole in soft gray lines. Try to express something of light and shade, and relative distance by making the side of the drawing, which is away from the light, a little heavier than the side toward the light. The outline of the most distant apples should, as a whole, be lighter than that of those nearer.



EXERCISE VIII. — Cylinder and Square Prism. — Appearance below the Level of the Eye.

MODELS: *Cylinder, Square Prism.*

OBJECT. To read a drawing of three views of two models, to place models in a corresponding position, below the eye; to study and to draw their appearance.

Steps in the Work. — Three geometric views of the group required are given in the drawing-book. The first step in this exercise is to read these views, and place the models in the position indicated with relation to each other.

The second step is to place the group thus obtained in front of and below the level of the eye, remembering not to place it so far below the eye that the effect will be exaggerated. A good effect will be obtained if the group is so placed that the top of the cylinder will appear quite narrow from back to front.

The third step is to study the appearance of the group, and to draw it of a suitable size, and well placed on the drawing-book page.

Relation of the Models. — This exercise is extremely important as it presents so many points with regard to the relation of the models. One of the first considerations in drawing a group is to see that the drawing will show that each model or object has sufficient room to stand. Too much emphasis cannot be laid on this point; beginners are very apt to overlook it. In order to make sure of this, it is well to draw the invisible parts of the base of each. If the bases of two objects standing in a group overlap, the drawing is wrong for it represents two bases as occupying some part of the same space.

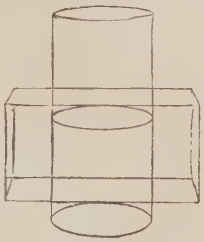
The relative appearance of the different faces according to their distance below the eye must also be carefully studied; unless the objects in a group are studied in relation to each other, the true effect cannot be obtained.

Spirit of the Work. — The purpose of every exercise in Representation should be to lead the pupils to see for themselves. Awaken their desire to obtain this power. Call frequently for the drawing of an object or group, before asking for answers to any question concerning the models.

A good teacher will endeavor to watch the development of the class and will adapt the method to the condition of the class. It may be well sometimes to conduct the exercise as just suggested, — at other times it may be well to carry out the exercise in the manner indicated in the "Suggestions" given below.

To be developed. — Placing models according to geometric views; ability to see relations of objects to each other; study of appearance; good drawing.

Suggestions for Study of the Drawing and the Models. — Read the drawing on page 10 of the Drawing-Book and tell what Figs. 1, 2, and 3 are. Place the models as indicated in Fig. 2 and below the eye. What is the proportion of the apparent height of the group to the apparent width? Which appears longer, — the square prism from left to right, or the cylinder from top to bottom? Which appears longer, — the nearer or the farther edge of the top of the square prism? How does the apparent width of the top of the cylinder from back to front compare with the top of the square prism? Consider what the apparent width from back to front of the invisible horizontal faces of the two models would be, compared with each other and also with the width of the top faces. A knowledge of the invisible faces as here illustrated is necessary in order to place the drawings correctly with regard to each other.



Exercise VIII., completed.

Drawing-Book, Exercise VIII. — Drawing the Appearance.

Directions. — Study the models carefully, taking measurement on the pencil. Determine about the space to be occupied by the drawing on the page, by light indefinite horizontals and verticals. Draw the appearance of the cylinder, drawing a complete ellipse for the base. Draw the appearance of the square prism. Draw the table line, as seen in the Drawing-Book, Exercise V., remembering that it should be above the farther line of the base of the square prism otherwise the group will appear as if projecting over the edge of the table and will give the impression of being insecurely placed. Finish the drawing in soft gray lines, making the farther lines a little fainter than the nearer ones.

EXERCISE IX. — Book opened. — Appearance in front of, and below the Level of, the Eye.

From an Open Book.

OBJECT. To study the appearance of an open book in front of, and below the level of, the eye; to draw the appearance.

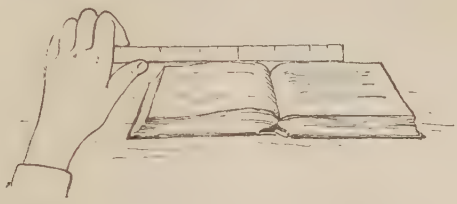
Method of Study. — Some study has previously been given to the appearance of rectangular objects. This study is now continued. It is the plan of this course to approach each subject in the simplest and most natural way, leading the pupils first to express what they see, without laying down any rules, and later leading them to develop the simple principles from their own experience. The method of studying the appearance of the open book is shown in the illustrations. It will be seen by the "**Suggestions for Study by Pupils**," given below, that pupils may be led to formulate an important principle as the result of their observations. It is desirable that pupils should be led to such a statement and that they should use this statement as a means of criticising their own drawings. Read what is said on pages 92, 93, concerning the selection of the book and the rendering.

The teacher will find the methods of study of the apparent shape of the open book and the apparent direction of its edges, given below for the pupils, of the greatest assistance in working out this exercise previous to giving it to the class. It may be well to take as new a book as possible, because of its well-defined edges. Study should also be directed to some characteristics of a book. Every pupil will know that the book differs from a block, but will perhaps be a little puzzled to tell just how without some careful leading. The materials of which a book is made, — the kind of cover, whether paper or board, flexible or stiff; the kind of binding, whether paper, cloth, or leather, — all contribute to its general appearance.

To be Developed. — Selection of a book; appearance of an open book; foreshortening of the top; nearer edges longer than farther edges; convergence of left and right edges; artistic rendering.

Suggestions for Study of the Object by Pupils. — Open the book as illustrated in the Drawing-Book, Fig. 1, Fig. 2, or Fig. 3, and *place it back on the desk, in front of you.* What is the general shape of the book as it lies open? (*An oblong, lying*

from left to right.) What is its thickness now, compared with its thickness when closed? Hold a ruler touching the farther edges of the book. Note the apparent width of the book from front to back. How does it compare with the thickness of the book?



Place a pencil vertically at each end of the lower visible horizontal edge. Close one eye, and incline the pencils toward each other until they appear to cover the left and right edges of the book. What is the apparent direction of the left and right edges? (*They appear to converge.*) Which *appears* longer, the nearer or the farther edge? (***The nearer edge appears longer than the farther edge.***)

Slip a string under the front ends of the book and study the direction of the receding edges (*edges extending away from you*). How many *receding* horizontal edges are there? With the left hand hold the ends of the string so as to hide the left and right edges of the cover; with the right hold a ruler vertical, with the edge toward you, so that it will hide the middle of the book from you. Where does the ruler meet the strings? If it does not reach them, where would it meet if prolonged? (*On the level of the eye.*)

What is the actual relative direction of the edges? (*Parallel.*) Imagine the left and right edges of the leaves continued; what is their *apparent* direction? (*Toward the point where the ruler and strings meet.*) What general conclusion do you draw from the study of the appearance of these edges? (*That all parallel horizontal edges, receding directly from the eye, appear to converge to a point on the level of the eye.*) Still holding the strings, place the ruler across them so as just to hide the farther edges; what is the general shape of the appearance?

Drawing-Book, Exercise IX. — Drawing the Appearance of an Open Book.

Study by Pupils to place the Drawing well. — What is the proportion of the whole height of the *appearance* of the book to its width? How wide a drawing can you

make on the page to look well? How wide a margin should you have at the left and right? (*Not less than an inch on a page of this size.*) At the bottom? (*Not less than three quarters of an inch.*)

Observation Exercises for Pupils. — Look out the window. Which do you see more distinctly, the objects near to you or the objects far away? What can you say about the relative clearness of outline of near and distant objects? (*The outlines of near objects are distinct, but those of distant objects are somewhat vague and indistinct.*) In drawing, the effect of distance is increased by making those parts farther from the eye less distinct than the parts nearer the eye.

Directions. — Draw a light horizontal for the lower line of the drawing, of a suitable length for the space to be occupied, and as far above the lower edge as determined in the study to place the drawing. Draw a horizontal for the level of the eye, *placing it as far above the drawing, in proportion to its size, as the eye is above the object itself;* if necessary slip a piece of paper under the upper edge of the page upon which to draw this line called L. of E. Place a point on L. of E. directly above the centre of the lower horizontal. Draw all horizontal receding edges toward this point. Finish in gray lines, varying in thickness, making the lines on the farther edges less distinct than those on the nearer edges, and making the receding edges a little fainter as they go farther from the eye.

EXERCISE X. — Square Prism and Cube turned at an angle of 45°. — Appearance.

MODELS: *Square Prism, Cube.*

If these models are not provided previous to this lesson, each pupil should make from pasteboard, or thick paper, a model of a square prism and cube having the proportion to each other of 1 to 2 in height.

OBJECT. To study and to draw the appearance of a square prism and a cube turned at 45°.

Appearance of Objects turned. — The appearance of rectangular objects such as the cube, the book and the square prism in front of and below the level of the eye, has already been studied. See pages 60–65 of this Manual, and also Manual, Parts I. and II. It is necessary also to study rectangular objects turned at various angles. An exercise in quick drawing of the appearance of various rectangular objects turned may first be given on practice paper. The method of study, to follow this quick drawing, is given below in the "**Suggestions for Study by Pupils.**" For the benefit of the teacher who desires to know something of theoretic perspective, a statement of its leading principles with illustrative diagrams is given in an appendix, pages 176–180.

Drawing. — It should be noted that the *cube and square prism are to be studied separately. Each should have its own table line.* If a continuous table line should be made for the two, the drawings would give a wrong impression.

To be developed. — Appearance of rectangular objects turned; relative appearance of horizontal edges above, below and on a level with the eye; quality of line.

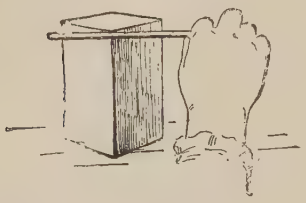
Suggestions for Study of the Models by Pupils. — *Square Prism.* Place the prism turned at an angle of 45° on a pile of books, so that the middle of the prism will be on a level with the eye. Fold some rather stiff paper to make two strips about $\frac{3}{4}''$ wide and 5″ or 6″ long. Hold the strips in one hand so that one strip can be kept vertical and the other easily moved up or down like the handle of a pump. Hold the strips at arm's length, so that the inner point of intersection will be between the eye and the nearest upper corner of the model, and so that the edge of the vertical strip will cover the nearest vertical edge of the model; then move the other strip up or down until it inclines as much as the horizontal edge *appears* to incline. Keep the strips parallel to the plane of your face. Study the other receding edges in the same way.

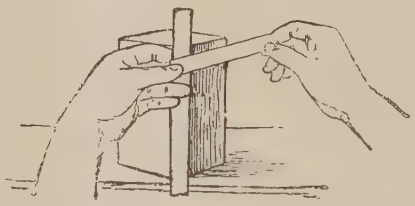
Compare now the apparent length of the vertical edges by measurement on the pencil; also the height and the width of the appearance.

Cube. Place the cube so that the top is on a level with the eye, and study it in the same way.

Study edges both above and below the eye, the edges of an open door, pictures on a side wall, books, boxes, tables, etc., all turned at an angle, and note that all receding horizontal edges above the eye appear to slant downward, and those below the eye appear to slant upward.

(The illustrations show the use of a pencil and of the strips of paper in discovering the apparent direction of receding edges.)



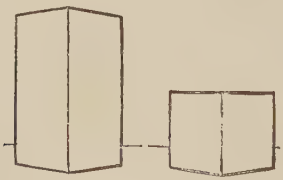


Drawing-Book, Exercise X. — Drawing the Appearance of the Prism and the Cube.

Directions. — Upon the left of the page, make a large drawing of the appearance of the square prism, placed so that the middle is on a level with the eye. On the right of the page, make a large drawing of the appearance of a cube, standing on a level with the square prism, having the top on a level with the eye.

Square Prism. Indicate the height and width of the drawing by light lines, noting the horizontal printed for the level of the eye. Draw the vertical for the nearest edge. Draw upper edges, then lower, slanting as much as they appeared to when the strips of paper were used; then left and right verticals. Draw a table line.

Cube. Draw the cube according to the directions for the square prism. Draw a table line. Finish in gray lines.



Exercise X., completed.

Exercise XI., completed.

EXERCISE XI. — Square Plinth turned at an angle of 45°. — Appearance below the level of the eye.

MODEL: *Square Plinth made by the pupil.*

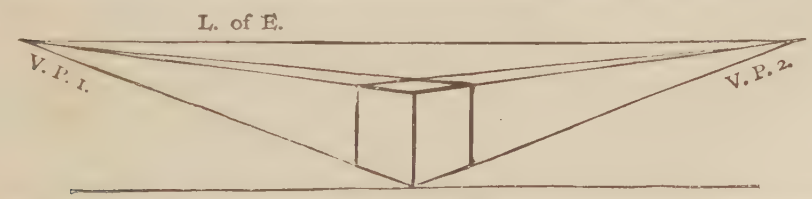
Proportion of height to width, 1 to 3; proportion of base to base of square prism, 2 to 3.

OBJECT. To study and to draw the appearance of a square plinth below the level of the eye, turned at 45°.

Appearance of the Plinth. — The study of the plinth in this exercise should be connected directly with the study of the cube and the square prism in Exercise X. It will be seen that the level of the eye is supposed to be the same for the three solids. The drawings should be made with especial consideration of that point.

Lead pupils to state during the study of the model that —

1. All receding horizontal edges appear to incline toward the level of the eye, and must be so drawn.
2. All parallel horizontal edges receding from the eye appear to converge to a point on the level of the eye, and must be drawn so that, if produced, they will meet in a point on the level of the eye (L. of E.).
3. Parallel horizontal edges receding to the left appear to converge to a point on the level of the eye at the left of the object; those receding to the right appear to converge to the right of the object. These points are called respectively Vanishing Point 1 (V. P. 1) and Vanishing Point 2 (V. P. 2).
4. For rectangular objects standing at an angle of 45°, V. P. 1 and V. P. 2 are equidistant from the object.
5. The farther vertical edges appear shorter than the nearer and should be so drawn.



The illustration given of the cube turned and below the level of the eye is an exemplification of these principles. It is delightful to see how pupils will deduce the essential laws of the change in the appearance of objects in different positions, from their own observation. These principles can also be confirmed and impressed by the study of square plinths above the eye, as in the case of the abacus of a column.

Drawing. — While pupils may see correctly the apparent direction and convergence of lines, they may not always carry the representation out correctly in

their drawings. It is frequently necessary for teachers to aid pupils in criticising their drawings in this respect, by direct application of their own statements. It requires long practice to learn to see and to execute correctly the appearance of objects. Too much should not be expected in one exercise.

To be developed. — Appearance of rectangular object turned; relative appearance of horizontal edges below the eye; relative appearance of nearer and farther vertical edges; quality of line.

Suggestions for Study of the Model by Pupils. — Place the square plinth turned at 45° so that its base will be as far below the eye as the base of the cube in the preceding exercise. Be very careful as to this placing, for it is desired that the drawing of the plinths should show the proper relation to the drawing of the cube and square prism. The three drawings when completed should show that their bases were at the same distance below the eye. Study the appearance of the plinth by the methods suggested in Exercise X.

Drawing-Book, Exercise XI. — Drawing the Appearance of the Square Plinth.

Directions. — Draw the appearance of the square plinth turned. Remember that the level of the eye on this page must correspond as to height on the page with that on the preceding page.

Plan for the drawing so that the base will be on a line with the drawings on the preceding page. Indicate the height and width of the drawing by light lines, noting the horizontal printed for the level of the eye. Draw the vertical for the nearest edge. Draw upper edges, then lower, slanting as much as they appeared to when the strips of paper were used, remembering to study carefully the apparent convergence, then left and right verticals. Draw a table line and finish in gray lines.

CHAPTER III.

DECORATION;

Or, Drawing as Applied in Ornament.

Decoration is the science and art of producing beauty in ornament. The study of the facts of form of objects in Construction, and of their appearance in Representation, is now properly followed by the study of Decoration, or the means of enhancing the beauty of objects.

Ornament, the product of purely decorative art, is always employed to beautify objects created for some purpose, independent of their decoration. It produces its legitimate effect when, without concentration upon itself, it makes the object to which it is applied more pleasing than if unadorned.

Fitness to its purpose is the underlying principle, — the very corner-stone of all good ornament. From this principle of fitness for its purpose there arises the fundamental law of ornament, — subordination. This law requires THAT ALL ORNAMENT SHALL BE MODEST AND MODERATE. Strong contrasts and striking effects violate it. Illustrations of this requirement in matters of good taste in general are familiar to all. A loud voice in conversation is not excusable; a forward, self-asserting manner is a mark of ill-breeding; gaudy colors in dress are shunned; showiness, or any other attempt to attract attention, is condemned. This requirement holds good in all ornament, whether architectural, domestic, or personal. He is not well dressed whose dress is conspicuous; that house is not well furnished where the furniture is obtrusive; that building is not well ornamented whose decoration is not subordinate to the idea of the building.

Ornament has two sources, — Nature and Geometry. In the minds of many these are widely separated. Geometry is too often considered as simply a treatise on an assemblage of figures and forms which have no particular meaning except as a basis for mathematical study. Such a view is most inadequate, for geometry is really the study of ideal and typical forms, which while not discoverable in a perfect state in nature, are deduced by man from a study of nature.

Nature presents no ideal forms; these are the result of man's thought led by nature. The forms of Geometry are ideals conceived by man in "thought's interior sphere," as archetypes of Nature, and thus the forms toward which Nature in evolution is constantly tending. Nature and Geometry are, then, but different manifestations of the divine law.

Much help concerning the sources of ornament, the materials of ornament, modes of arrangement, parts of a design, use of plant form and historic ornament will be found on pp. 56–59.

Quality of Line in Decoration. — In Representation, a drawing is intended to represent the appearance of an object, or group of objects, and therefore to express not only the appearance as to mere outline, but also as to distance, as to direction of light, and as to relative importance of parts. It is in Representation, therefore, that what is known as "rendering" is used, giving more emphasis to some parts and less to others, according to their light, their distance, and their value, by lines varying in thickness and in quality.

In Decoration the purpose is different. No effect of light, shade, distance, or value is desirable in flat decoration. A decorative figure should be drawn in the simplest possible way. It should be drawn with intelligence, with strength, with purpose, with firmness. The line should be open in texture, of an even gray color, and of an even width. Venation may be expressed (it should be sparingly, however) by a line tapering in width. Unevenness of line in decorative outline detracts from repose.

EXERCISE XII. — Border of Reversed and Spiral Curves.

OBJECT. To study and to draw a border of reversed and spiral curves.

The Spiral. — There are two varieties of the spiral; the equable spiral, Fig. 1, and the variable spiral, Fig. 2.

Fig. 1.

Fig. 2.

Compare the two figures; in the equable spiral, Fig. 1, the distance between the spires is the same throughout; in the variable spiral, Fig. 2, the distance between the spires increases continuously. A method of illustrating the curve of the equable spiral is given on page 73. The curve of the variable spiral may be illustrated by unwinding a cord, not from a cylinder but from a cone, the piece of crayon attached to the free end of the cord describing the curve, as in the illustration of the equable spiral given on page 73. The cord should be pinned or otherwise fastened at the larger end of the cone and *wound* toward the vertex. In describing the curve, the vertex of the cone should be held against the board, and the cord should be gradually *unwound* from the vertex to the base, the crayon fastened to the free end of the cord being held against the board so as to trace a continuous spiral. A boy's top is a good illustration.

The spiral is frequent in ornament and is found in all styles. The Egyptian wave scroll shows the equable spiral. The Roman scroll illustrated on the next page tends toward the variable spiral. The study of the spiral in connection with tangential union, as shown in this exercise, gives pupils possibilities for an almost infinite variety in original design. A direct application is found in Book VI., in the *fleur-de-lis* of Exercise XIII. and the Gothic leaf of Exercise XIV.

Egyptian Wave Scroll.

To be developed. — Appreciation of curvature; tangential union; free continuous movement; quality of line.

Suggestions for Study of the Copy by Pupils. — With pencil in hand, move over the long curve which passes through the border; what kind of a curve is it? (*A reversed curve.*) A reversed curve repeated forms what is called a ***wave line.*** What other curves are there in the border? (*Spiral curves.*) Begin movement again over the reversed curve, but pass around over the first spiral; repeat. How does the curve of the spiral unite with the reversed curve? (*Tangentially.*) Describe the movement from the reversed curve into the spiral. (*It is continuous — unbroken.*) Repeat the movement over the reversed curve into the other spirals; notice that the second movement is simply the reverse of the first. The tangential union here discovered is an important element in the harmony of the design. Be careful to express it in your drawing. *Alternation* of effect is here produced by the reversal of the *repeat.* How many repeats are there in the border?

This border combines the graceful curvature and the tangential union of lines found in Greek ornament; and it is the basis of the *scroll,* which was developed and elaborated from the simple wave line into one of the most perfect decorative forms ever employed.

Drill Exercise. — Variable Spiral.

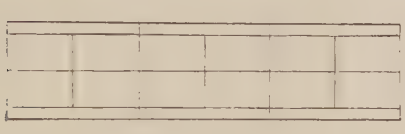
Study of the Spiral by Pupils.* — Describe the direction of the line in this figure. The figure is called a *spiral.* As the line goes round and round, how do the distances between the parts compare at different points? (*They are constantly increasing.*) There-

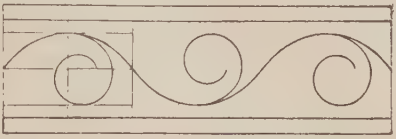
* If the later edition of Book VI. is used, a drawing of the variable spiral should be upon the board and the drill exercise given on practice paper.

fore this figure is called a *variable spiral.* One revolution of the line is called a *spire.* Can you mention any object that resembles this?

Practice. — Beginning at the centre of the figure and pointing the pencil toward the left, trace the curve throughout. Repeat, then draw with continuous motion.

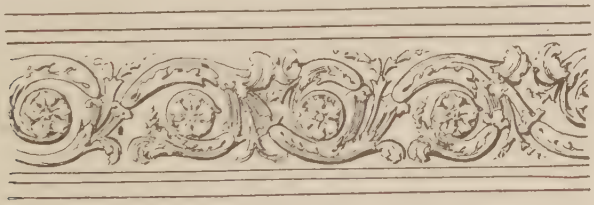
Drawing-Book, Exercise XII. — Drawing the Border.





Study by Pupils. — In the first repeat of the border on page 15 there are light lines; what is their purpose? (*To assist in laying out the figure.*) What are they called? (*Construction lines.*) The illustrations below show the construction lines, together with the example given in the Drawing-Book.

Directions. — Lay out the space for the border as in the illustration at the left, drawing lightly the marginal lines. Trisect the inner lines and bisect the left vertical. Draw the construction lines through the whole length of the border. Practice movement over the reversed curve of the copy, then over the construction lines just drawn; then draw the curve continuously. Repeat for the spirals, beginning movement on the reversed curve and carrying it around over the spirals. Erase construction lines, and finish in even, gray lines.



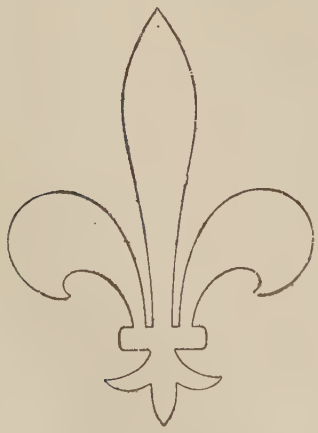
EXERCISE XIII. — Fleur-de-lis.

OBJECT. To study and to draw an example of good historic ornament.

Historic Ornament. — Good historic ornament is always ennobling, for it is an expression of the best and most enduring feeling; it is, in a very high sense, "a survival of the fittest." A lesson in historic ornament may and should be not merely a lesson in drawing, but also, to a greater or less degree, a lesson in history and æsthetics, in living and in doing.

Fleur-de-lis. — This ornament has been, like most favorite ornaments, variously modified in different ages and countries. It seems to be a type that has found recognition among all people — a type corresponding to a universal thought. Some interesting notes on its occurrence in ornament will be found on pages 70–72.

Read carefully what is said on page 72 on the character of the ornament. Study also the suggestions given on page 74 for the "**Study of the Copy by Pupils.**" Lead pupils first to an appreciation of the given example as a whole — its proportion and general shape. Then consider its proportional division and the beauty of its characteristic curves. Try to have pupils picture to themselves this fleur-de-lis ornament as a whole before drawing it. This is a good example for an exercise in memory drawing. Pupils should have fixed in their minds a few of the great types of ornament, to take their place among "memory gems." At least one fine type should be added each half year.



Florentine Fleur-de-lis. — The Italian modifications of the fleur-de-lis are very interesting. The upper part only of a Florentine fleur-de-lis is given in Drawing-Book V. for this exercise. The complete figure is here illustrated, and is given as an example to be reproduced in Drawing-Book VI. The upper part of a fleur-de-lis is often used in heraldry.

The fine proportions and grace of curvature in this figure should be noticed. Some slight changes in proportion or curvature might change the whole character of the ornament; the necessity, therefore, for very good examples as copies will be seen.

Drill. — In order to give the character desired to the drawing of the fleur-de-lis, it is necessary to have great freedom of expression. The drill exercise for the spiral, in Exercise XII., affords admirable practice here.

To be developed. — Idea of the example as a whole; beauty of proportion, division, and curvature; quality of line.

Suggestions for Study of the Copy by the Pupils. — Observe the figure printed in the drawing-book and describe it. Can any one give the name? (*It is a Fleur-de-lis.*) Can you recall any figures that you have seen similar to this, but differing from it a little? This particular form of the Fleur-de-lis is known as the Florentine Fleur-de-lis. As you draw this ornament, study it so that you will be able to draw it from memory at any time. It is one of the beautiful types of ornament that has lived for centuries, and is a part of the heritage of beauty that has come to us from the past.

Drawing-Book, Exercise XIII. — Drawing the Fleur-de-lis Ornament.

Observation Exercises for Pupils. — What is the proportion of the copy? About how high can you make your drawing in the space at the right, leaving a suitable margin at the top and bottom?

Directions. — Draw the copy, enlarged, to fill the space at the right. First draw a light centre line, then blocking-in lines. Before drawing each curve, practise movement over the copy to get the feeling of the curve. Erase the centre and blocking-in lines and finish the Fleur-de-lis, in soft, even, gray lines.

EXERCISE XIV. — Ivy Leaf. — Twelfth Century.

Three and five lobed ivy leaves brought in by pupils.

OBJECT. To study a Gothic ivy leaf; to compare it with natural leaves; to draw it.

The Gothic Style. — During the first ten Christian centuries, architecture and decorative art were governed by the traditions of that art called *classic*, the art of the Greeks and Romans; but little by little the people in their own desire for

growth threw off these traditions, and the fresh spirit of incoming nations added to this impulse.

There arose in France, in the eleventh and twelfth centuries, the beginnings of a new style of architecture, differing very much from the preceding great styles, introducing pointed gables, pointed arches, vaults, pinnacles, and towers. This style, like all other styles of architecture, reflected the feelings and nature of the

people from whom it came, — strong, skilful, aspiring, respecting the individual as well as the mass, vigorous, full of new life and new thought. To those who clung to the old traditions of the Greek and Roman styles, the new style seemed barbarous and they called it the Gothic style in derision, for the Goths who overran Europe in the early Christian centuries and made great conquests were a tribe of barbarians. But the term, first applied as a reproach, has become a glory and now represents one of the most beautiful styles in architecture. The illustration on the preceding page shows a magnificent example of Gothic architecture, — the Cathedral of Paris, known as Notre Dame. On the right a gable will be seen. This is one of the gables of the transept, and is given enlarged below. This gable is said never to have been surpassed in architecture.

Decorative art had been much modified during this time by Christian symbolism, as seen in the quatrefoils and crosses. The quatrefoil is an example of historic ornament found noticeably in the Byzantine and Gothic styles, although as a simple figure it occurs occasionally in earlier and even in primitive ornament. It appeared prominently in architecture and in decoration early in the Christian centuries. The people loved to make and to have before them in their churches things that would remind them of the religion that was so sacred to them.

Therefore they put into their churches symbolic figures, — figures which by their color, their shape, or the number embodied, would recall to them some part of their religion. Their decoration was full of symbols. All four-leaved figures stood to them as emblems of the four evangelists, Matthew, Mark, Luke, and John; trefoils as emblems of the trinity. The semicircle in the quatrefoil, as well as in the kindred trefoil, represents the *nimbus* or glory of the head; so that the quatrefoil is doubly symbolic. Wherever it appeared, not only in flat decoration but also in window tracery and in other wood and stone work, it was a symbolic figure. Trefoils and quatrefoils will be seen in the beautiful ornamentation of Notre Dame in both illustrations.

Decorative art, intimately connected as it is with architecture, changes in style as the architecture changes. The architects and builders of the Gothic style were not content with classic ornament, and, in addition to their symbolic ornament, sought for inspiration among the plants of the field. They did not imitate these plants, but through loving study obtained from the plants motives for ornament. The expression of vigorous growth is one of the strong characteristics of Gothic ornament.

Viollet-le-Duc, the great French architect and architectural writer, says: "They do not endeavor in fact to reproduce, with all the care of a naturalist, such or such a plant, but to find a motive of ornament. . . . Plants have a manner, a physiognomy, a carriage, which first strikes an inexperienced observer. He seizes the general character without going further; he produces a second creation that becomes a work of art, though one rediscovers in this second creation the powerful imprint of nature."

The example of an ivy leaf from early Gothic ornament in the drawing-book becomes most interesting from this point of view. It was selected for study here because it not only beautifully represents the spirit of Gothic ornament, but also because its study can so easily be connected with the study of the natural leaves that inspired it.

The ivy leaf frequently occurs in Gothic ornament. The example here illustrated is from flat decoration in Sainte Chapelle, a most beautiful early Gothic church. The example at the close of the exercise is of sculpture from the Cathedral of Amiens.

To be developed. — Idea of the example as a whole; its source and character; balance and growth; varied character of line.

Suggestions for Study of the Copy by Pupils. — Look first at the ivy leaves which you have; how many parts or *lobes* have your leaves? (*Some have three, some five.*) How many lobes has the copy given in the drawing-book? Look at its centre lobe; has any one an ivy leaf having such curves in the centre lobe as those of the copy? Study the other curves of the copy in the same way.

The leaf given in the drawing-book is from a leaf found in early *Gothic ornament,* — ornament of the *twelfth century.* Certain characteristics and leading curves of the ivy leaf were studied and reproduced, all minor details being omitted; and a conventionalized ivy leaf and tendril in the simple, strong, early Gothic style was produced.

Study the blocking-in given in Fig. 2. What is the general shape of the blocking-in? What is the proportion?

Fig. 1

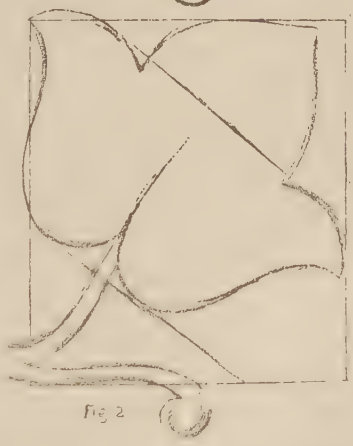


Fig. 2

Drawing-Book, Exercise XIV. — Drawing the Leaf.

Observation Exercises for Pupils. — This leaf (Fig. 1) looks strong and vigorous; it is apparently holding itself erect; how is this effect produced? (*By the strength in the drawing of the stem and midrib.*) This strength is seen (1) in the directness of the line of growth, the general direction of this line being easily expressed in but two straight lines; (2) in the breadth of the stem.

The figure looks well-balanced also. But if a central vertical were drawn, it would not divide the drawing into two corresponding parts; the effect of *balance* in the figure is not produced by repetition on an axis. Can you tell how this effect is produced?

Study the copy to discover why it looks well-balanced. Apparently the leaf-stalk and tendril first shot outward to the right, but the life and vigor within carried the leaf upward; the growth upward apparently counteracted and to a certain extent conquered the outward tendency; the two balance each other. This is all expressed by the direction of the leaf-stalk and midrib, holding up the leaf. The end of the leaf-stalk

is left open, unfinished, to indicate that the whole form is not given; the curvature also indicates that the leaf is still receiving strength from the main branch, which adds to the impression of balance and ***stability***.

Directions. — Block in an oblong of the proportion shown in Fig. 2, and of suitable size for the space, first indicating its height and width by light lines, then drawing the oblong. Draw the oblique lines, as further aids in obtaining the shape of the leaf. Indicate the midrib and stem, block in the leaf and the tendril, and draw the curves over the blocking-in lines. Study to produce the effect of strength and balance in the drawing. Erase the blocking-in and finish in gray lines, modifying them as shown in the example.

EXERCISES XV. and XVI. — Decorative Design. — Border.

OBJECT. To study the modification of units for borders; to design and draw a border.

Unit of Design. — In Manual, Part II., it was shown that repetition is a universal feature in decorative design, and the four modes of repetition were illustrated. Some of the figures used for repetition are to be considered in this exercise. A figure used for repetition in decoration is called a unit of design. The unit is an extremely important part in decorative work. It must have proportion, variety, grace in its outline. It must be simple and not obtrusive. Much practice and much study of proportion, curvature, and growth are required to make a really good unit. Therefore the study of the unit and different modifications is repeatedly given in this course of instruction.

Shape of Units. — Units may be circular, square, or oblong, as Figs. 1, 2, 3. The five rectilinear figures here given — the square, the oblong, the rhombus, the rhomboid, and the kite-shaped figure, or regular trapezium — are five of the six

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6.

principal quadrilaterals. The sixth is the regular trapezoid. A trapezoid is a figure which has two of its sides parallel; a regular trapezoid is very easily made by cutting off the vertex of an isosceles triangle by a line parallel to the base. The trapezium is a figure having no two of its sides parallel.

The Kite-shaped Unit. — This has always been a great favorite. It has symmetry and proportion. Symmetry is produced by repetition on an axis, called the axis of symmetry. Proportion in art is the pleasing relation of unequal

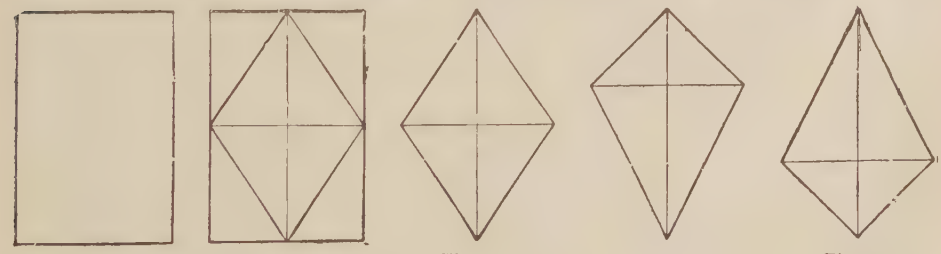
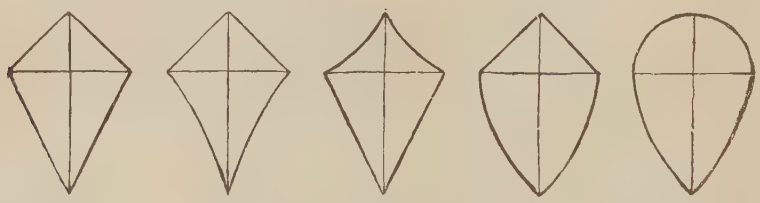


Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 11.

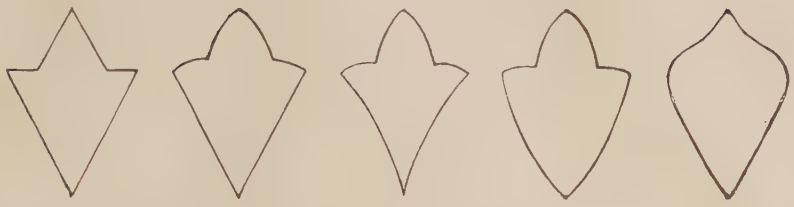
parts. This unit is susceptible of innumerable changes of outline and proportion, while still retaining its characteristics through all the changes, and remaining kite-shaped. Its deviation from the oblong is interesting, — first, the oblong, Fig. 7, a figure having four sides and four right angles, only its opposite sides being equal and parallel; next, the rhombus, Fig. 9, a figure having four equal sides but none of its angles right angles, which may be obtained from the oblong by connecting the ends of its diameters, Fig. 8; then the kite-shaped figure, Figs. 10 and 11, an oblong figure having four sides those only being equal which are on opposite sides of the axis of symmetry. The kite-shaped figure may be obtained from the rhombus by changing the place of the greatest width of the figure. As a diameter must pass through the centre of a figure, the horizontal in the kite-shaped figure is not a diameter, but simply a construction line marking its greatest width and showing, when compared with the axis, the proportion of the figure. The greatest width of the kite-shaped unit may be at any point in the axis outside the centre; or, in other words, considering the figure in its normal position, the greatest width may be above or below the centre, but not at the centre of the axis. Its normal position is with the axis vertical.



Modifications. — The line of illustrations above, from the Manual text for Book II., show some of the simple modifications that may be made in the kite-shaped unit by changing a part or the whole of the outline from straight to curved lines. The geometric derivation of this unit has already been shown. These modifications give a suggestion as to a possible derivation from a natural form, the leaf. See Manual, Part I., page 108. Thus, as has been said, it is difficult at times to distinguish between the two sources of ornament, geometry and Nature. Geometry contains the types or ideals of all form.

The modifications on the next page show units that may be used in borders. Still further modifications may be introduced, to give stability, strength, and variety. In the modification of units the curves should not be deep.

For modes of modification, study what is said under the headings **Stability, Strength**, and **Variety**, on pages 75, 76, also under the headings, pages 77–79.



By considering the units which the pupils draw, in the ways suggested on the pages mentioned, teachers will find themselves not only able to criticise the units, but also to develop in the pupils an appreciation of grace, simplicity, and repose in ornament. Lead them also to individuality — to an endeavor to make the unit expressive. In seeking originality, however, the principles of good design must not be overlooked.

To be developed. — Grace; simplicity and repose; suitability to position and space; free movement; even gray lines.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Suggestions for Study of the Modification of Units. — Open your drawing-books at Exercise XVI. What is Fig. 1? (*A border made by the repetition of circles.*) Fig. 2? (*A border made by the repetition of the kite shape, modified.*) How is the unit changed? (*The lower part is cut off, giving the effect of greater stability.*) Describe Figs. 3, 4, 5, and 6. Do the units of Figs. 2 and 3 and of Figs. 5 and 6 resemble each other? (*The units of Figs. 2 and 3 show the blocking-in of the units of Figs. 5 and 6.*)

Exercise XV. — Practice for Exercise XVI.*

Directions. — Draw on the first centre line the blocking-in and construction lines of a unit. Draw the unit, modifying the shape given but taking care to make it simple. Repeat the unit on the second centre line. Erase the construction and blocking-in lines and finish in even gray lines.

Drawing-Book, Exercise XVI. — Drawing a Border.

Directions. — Draw long horizontals as marginal lines for a border, extending as far to the left and right as the borders above. Divide the third horizontal from the top into six equal parts, by first bisecting the line and then bisecting each division. Beginning a little below the second horizontal, draw to each point of bisection a vertical as a centre line for a unit. On these lines draw units, following the preceding directions. Erase the centre and blocking-in lines and finish in even gray lines.

OPTIONAL EXERCISE. — MEMORY DRAWING.

OBJECT. To give pupils practice in drawing from a mental image.

Memory. — It is suggested that a page shall be used for a memory drawing. The mind of every pupil holds, in a greater or less degree, certain form images. These images are in most cases somewhat vague, although they are sometimes quite clear. The power of recalling and strengthening these images should be cultivated. The effort to recall them by drawing should be encouraged.

Historic ornament furnishes admirable material for memory drawing. By the use of such material the mind becomes stored with types of ornament, beautiful images, and filled with elevating ideas of graceful curvature and ennobling proportion.

It is also a good plan to have memory drawing of models, and objects, and groups, — either facts or appearance. If a page is used for such drawings, "From memory," should be written under the drawings, that they may be judged from the proper standpoint.

* If the later edition of Book VI. is used, this exercise can be carried out on practice paper.

CHAPTER IV.

REVIEW.

Construction, Representation, Decoration.

Review. — It is desirable as the end of the term approaches, to review the three subjects, — Construction, Representation, Decoration, — in order to fix the principles of this book before passing to another book, and perhaps to another room and perhaps to another teacher.

EXERCISES XVII. and XVIII. — Oblong Block. — Three Views. — Dimension Lines.

MODEL: *A Brick or a Block of the same size and proportion.*

OBJECT. To make three views of an object, giving not only the facts of its form, but also its size: to make a "figured" drawing.

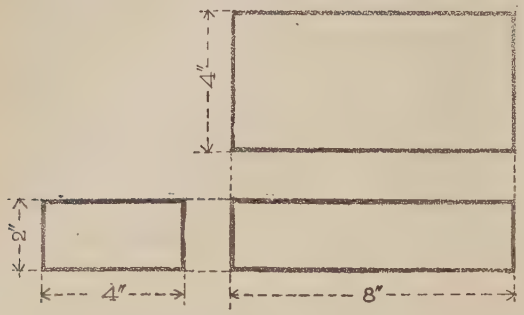
Purpose. — The purpose of this Exercise is to review geometric views and their relative placing, the use of extension lines, and, in short, to fix in the minds of pupils what they learned of Constructive drawing in the early part of the book. The exercise also carries the work still farther, and enables the pupils to add dimension-lines and figures to his drawing of views, thus making a complete working-drawing.

To be developed. — Recollection of conventions; use of dimension lines in figuring; free drawing; even lines.

Suggestions for Study of a Block by Pupils. — Here is a block, resting on its long, broad face, the long, narrow face in front of you. You wish to make a drawing from which a carpenter could make a block, having the same form. What are its dimensions? (*2″ thick or high, 8″ from left to right, 4″ from back to front.*) How many inches wide is your drawing-book? Is it wide enough to make the left end and front views full size? What can you do then? (*Make the views of the same proportion as in the object, and mark the size.*) What is the shape and proportion of the front view? (*An oblong of the proportion of* 1 *to* 4, *with the long sides from left to right.*) Of the left end view? Of the top view?

Open your drawing-books and see how the dimensions are marked there. The dotted lines with a dimension marked in the centre are called the *dimension lines,* —

arrow heads show the limits of the dimension. Such a drawing is called a *"figured"* drawing, because the dimensions are given in figures. Note the short dash lines extending from each view, for the purpose of carrying the dimensions out a little from the view. A drawing which shows, as this does, the facts of *form* and *size* of an object is called a *working-drawing.*



Study for laying out the Page. — On this page you wish to make a large drawing of the three views. How can you plan for a left view, and for a front view twice as wide as the side view? (*Allowing about* $\frac{3}{4}''$ *for the margin at left and right; then make the left view* $2\frac{1}{2}''$ *and the front view* $5''$, *leaving* $\frac{1}{2}''$ *space between these two views.*)

Drawing-Book, Exercise XVII.* — Practice for Exercise XVIII. — Drawing three views of a Block.

Practice. — Draw a horizontal across the page, $\frac{1}{2}''$ above the lower edge. Determine the width for left and right margins and for left end and front views. Determine the proper height of these views, and draw another horizontal across the page.

From the points made on the lower horizontal for the left end view, move upward to the upper horizontal, and draw verticals downward to the lower horizontal, thus completing the left end view.

Complete the front view in the same way by verticals.

From each end of the front view move upward nearly to the title, and draw verticals to the verticals of the front view. Draw a horizontal for the base line of the top view $\frac{1}{4}''$ above the front view, determine the proportion of the top view by study of the front and left end views, and draw the upper horizontal. Add the dimension lines and figures.

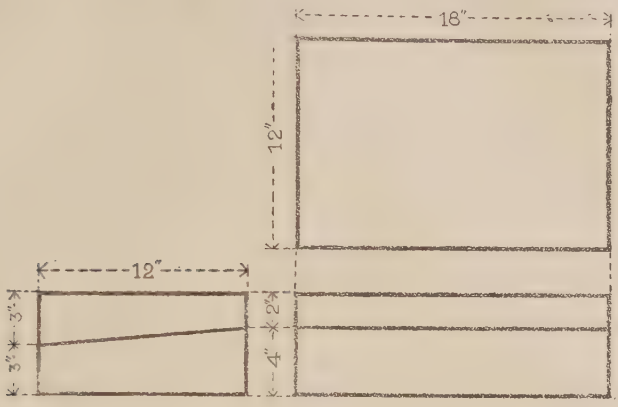
Suggestions for Study by the Pupils for Exercise XVIII. — Recall the study given in the preceding exercise, with regard to working-drawings. If possible, have working-drawings of simple objects to show, and let the pupils read them, giving the dimensions.

Drawing-Book, Exercise XVIII. — Drawing three views of a Desk, figured.

Observation Exercises for Pupils. — What object does the working-drawing on this page represent? *Read* the drawing, that is tell what it means. (*The drawing shows the front, left, and top views of a writing-desk,* $6''$ *high,* $12''$ *from back to front,* $18''$ *from*

* If the later edition of Book VI. is used, this exercise may be given on practice paper.

left to right. The front view shows that the upper part of the desk is 2″ *high at the front and the lower part* 4″ *high. The left view shows that the upper and lower*



parts are each 3″ ***high at the back; and that the desk when opened would slant from*** 4″ ***high at the back to*** 2″ ***high at the front.***)

Can you make a desk from the drawing? If you try, remember that the piece for the bottom should not be as large as that for the top; the pieces for the ends should not be as long as the end view in the drawing; allowance should be made for the thickness of the sides.

Directions. — Lay out the views according to previous directions. Finish the views in even lines; add the dimension lines and figures.

EXERCISE XIX. — Cube turned at an angle of 45°. — Appearance.

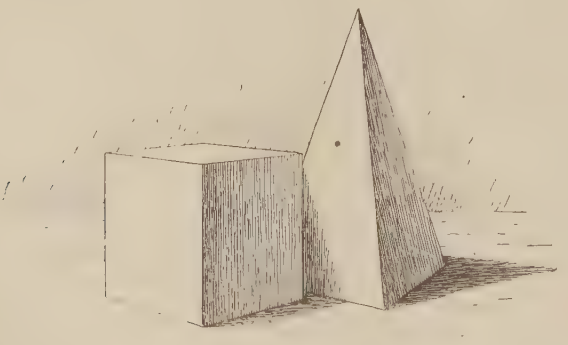
MODEL: ***Cube made by pupils for Ex. X.***

OBJECT. To study and to draw the appearance of a cube turned at 45°.

Purpose. — The purpose of this exercise is to recall to pupils by farther practice what they have already learned about the appearance of objects when turned and below the level of the eye. And it requires long practice to draw correctly the appearance of objects. The eye gains clearer vision only by practice; the mind gains clearer thought only by practice; the hand gains the power of clearer expression only by practice.

The exercise may be varied if teachers think desirable by giving to some pupils models to draw, and to others, objects based on those models. But in any case, such objects should be chosen as will emphasize the principles already gained. It must not be forgotten that in all drawings in Representation, the lines should be varied to represent distance, relative importance, etc.

To be developed. — Recollection of principles already attained; clearer vision; clearer thought; clearer expression; soft, open, varying gray lines.



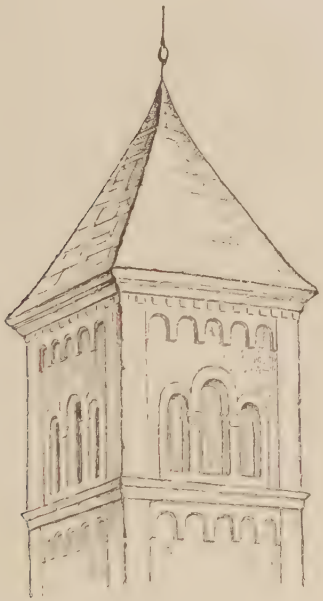
Suggestions for Study of the Model by Pupils. — *Cube.* Place the model turned at an angle of 45° on a pile of books, so that the top of the cube will be slightly below the level of the eye. Study the cube as suggested for Exercise X., page 53.

If the teacher prefers, the square pyramid may be substituted for the cube in this exercise, or they may be used in a group.

Drawing-Book, Exercise XIX.

Observation Exercises for Pupils. — Consider the size of page 22 and how large it would be well to make your drawing. Decide upon the proper placing for the drawing.

Directions. — Indicate the height and width of the drawing by light lines. Draw the vertical for the nearest edge. Draw upper edges, then lower, slanting as much as they appeared to, when the strips of paper were used, studying the convergence carefully — then left and right verticals. Draw a table line.



EXERCISE XX. — Natural Growth. — From Nature.

Each Pupil should bring a Branch of Leaves.

OBJECT. To study plant-form and growth from a natural branch.

The Example. — In the Drawing-book, the flax flower is illustrated. The whole plant is one of extreme delicacy. The example was chosen to show the bud, the half-opened flower, and the full flower in different positions, showing more or less fore-shortening. If pupils can have sprays, showing flowers in different positions, they will gain greatly through the relative appearances of the flowers. If this is not possible, they might place the spray in two different positions and make two drawings. Pupils may place the stem of the spray between the leaves of a book standing. It must be remembered, however, that too near a view is not desirable, and that pupils will generally get a better effect by drawing from a spray that is quite a little way from them. Read carefully pages 95 and 96 before giving this exercise.

Selection. — There is no principle more strongly to be emphasized in art than that of selection. Always seek for the most beautiful objects for drawing. Lead the pupils to see that there is great choice as to the way a spray is placed for drawing. It should be placed so as to appear characteristic and so as to present its most beautiful aspect. Give a short exercise in discovering the best-balanced and most beautiful position for the spray.

Rendering. — Good rendering is the result of two things — practice for ready and responsive execution, and a feeling for that which is to be rendered. Therefore endeavor, first, to lead pupils to see and feel the beauty, and then to express the truth of that beauty.

To be developed. — Study of nature; enjoyment of the beautiful; expression of character and beauty; good rendering by varying line.

Study of a Spray or Branch. — Place the spray or branch in a book, as described on page 97. Notice the general character of your branch; is it sturdy, showing vigorous growth, or is it delicate? What is its general direction? Place the spray so that it will show its full beauty. Notice how the leaves and flowers are placed on the stem, how they spring from the stem, and in what order they appear. Notice any fore-shortening. Study the light and dark side. How can you express the beauty?

Drawing-Book, Exercise XX. — Drawing the Branch or Spray.

Study for Character of Lines by Pupils. — Notice that you cannot in your natural branch see all of the edge of each leaf distinctly. This can be expressed in your drawing by broken lines and lines of varying thickness. If your leaves are toothed, do not try to draw each tooth, — merely indicate one now and then.

Directions. — Plan for a large drawing on the right half of the page. Block in the stem and the shape of the whole mass by a few light lines. Block in the flowers and the midribs and outlines of the leaves. Draw the curves of the stem and leaves and flowers over the blocking-in lines. Erase the blocking-in lines where necessary. Finish the branch in gray lines, varying in thickness, making them darker on the side away from the light.

OPTIONAL EXERCISE.

The last page in the Drawing-Book may be used for an exercise on any part of the work in the book in which the teacher may think the pupils need further practice, or it may be given to an exercise in color and the use of colored paper. For suggestions with regard to color, see pages 98–103; see also "Suggestions for the Study of Color"* which gives definite direction for the use of colored paper in Book VI. The colors to be used are the intermediate colors, red violet, red orange, yellow orange, yellow green, blue green, blue violet, their tints and shades. Assortment EE of The Prang Standard Colored Papers furnishes the necessary material.

The study of iridescence seems especially appropriate with the intermediate colors. The quality of iridescence is finely shown in insects, that are like "winged flowers or flying gems." They exemplify also the effect of small bits of brilliant color. Caterpillars, butterflies, and moths are especially good examples of the harmony possible among positive colors when they are used in small quantities and with mediating color.

A gentle word or two, like those of the verse quoted below, will do much to turn the attention of the pupils pleasantly and lovingly toward the beautiful insect world.

"Little thoughtful creatures sit
On the grassy coasts of it;
Little things with lovely eyes,
See me sailing with surprise.
Some are clad in armor green —
(These have sure to battle been);
Some are pied with every hue,
Black and crimson, gold and blue;
Some have wings and swift are gone,
But they all look kindly on."

— Robert Louis Stevenson.

* Published by The Prang Educational Company.

FORM STUDY AND DRAWING IN OTHER STUDIES.

The work in Form Study and Drawing will produce comparatively small results unless teachers recognize its close relation to everything about us, and hence the use that can be made of it in all the elementary as well as many of the higher studies. The pupils should be constantly observing form, and as constantly expressing it through drawing. The teacher's work at this stage should be so laid out that Form Study and Drawing will be constituent parts of all school work, enlivening and enriching it, whether Number, Geography, Language, Science, History, or Manual Training. Pupils need no urging to do illustrative work; they need only permission and encouragement. If such work is arranged so as to employ what they have learned in their regular lessons in Form Study and Drawing, the regular instruction will help the free use of drawing in other work, and the free drawing will help the regular instruction. For further suggestions with regard to this topic, see pages 106–108.*

Throughout the regular work in Form Study and Drawing, as laid out in Drawing-Book VI. and this Manual, teachers should continue to give pupils practice in the use of terms and names learned in the previous form study, as well as in the use of those given below, always requiring complete sentences.

Names of Models, Objects, and Details.

CONE, PYRAMID: frustum, slant height.
TRIANGLE: isosceles, scalene, right-angled, acute-angled, obtuse-angled.
SPIRAL: equable, variable, spire.

Terms of Construction.

FACTS: foreshortening.
LINES: centre, working, full, dimension.

Terms of Representation.

APPEARANCE: foresnortened.

Terms of Decoration.

HISTORIC ORNAMENT: scroll, wave line, Gothic ornament, fleur-de-lis.
MOTIVE: geometric, historic, natural.
ARRANGEMENT: alternation.
EFFECT: balance, stability.

* THE PRANG EDUCATIONAL COMPANY has in preparation a Manual on Drawing in other Studies.

APPENDIX.

1. THEORETIC PERSPECTIVE.

FORMERLY object drawing was taught by first giving a course in theoretic perspective. This was done that the student might have certain fixed principles and diagramic formulæ by which he might be guided in object drawing, and by which he might correct his errors. It became apparent, however, as this method was continued, that a student might be admirably grounded in theoretic principles, diagrams, and problems, and yet be quite unable to see or to draw the appearance of an object. This is only another example of the educational contest, words *versus* things.

Therefore, methods in object drawing have been changed. Object drawing now begins by a study of the appearance of the object. From that study, pupils are led to

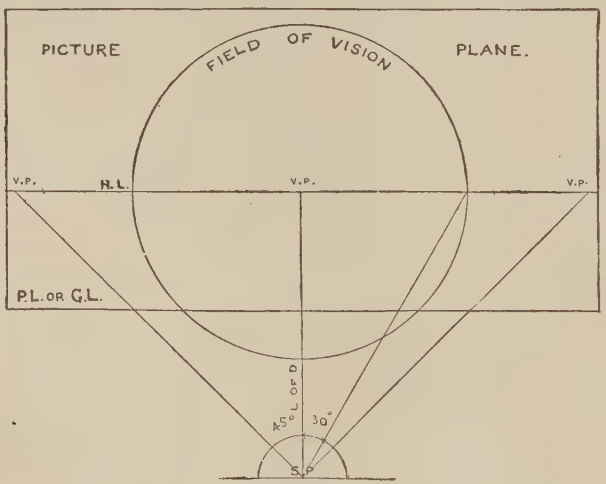


Fig. 1. Perspective Diagram.

deduce certain general principles which govern the appearance of objects in different positions. For examples of these methods, see Manual, Parts I., II., III.

It is well, however, that teachers should know something of theoretic perspective so

as to meet any questions that may be raised by the advocates of the old method of teaching, as well as to understand something of what is a very interesting science.

A drawing made according to theoretic perspective is the representation of an object or scene as if seen through and therefore upon a pane of glass. It is necessary, then, to imagine a plane (which takes the place of a pane of glass) called the Transparent Plane, the Plane of Delineation, the Vertical Plane, or most generally the Picture Plane (P. P.). The flat surface of paper upon which a perspective drawing is made represents this plane.

The eye of the observer is supposed to be fixed and immovable at a point called the station point (S. P.), looking along an imaginary straight line called the Line of Direction (L. of D.) to a point called the Centre of Vision (C. V.), which is directly opposite and on a level with the eye, and the Vanishing Point (V. P.) of all lines at right angles to the Picture Plane. The line at the level of the eye is sometimes called the Line of the Horizon (L. H. or H. L.).

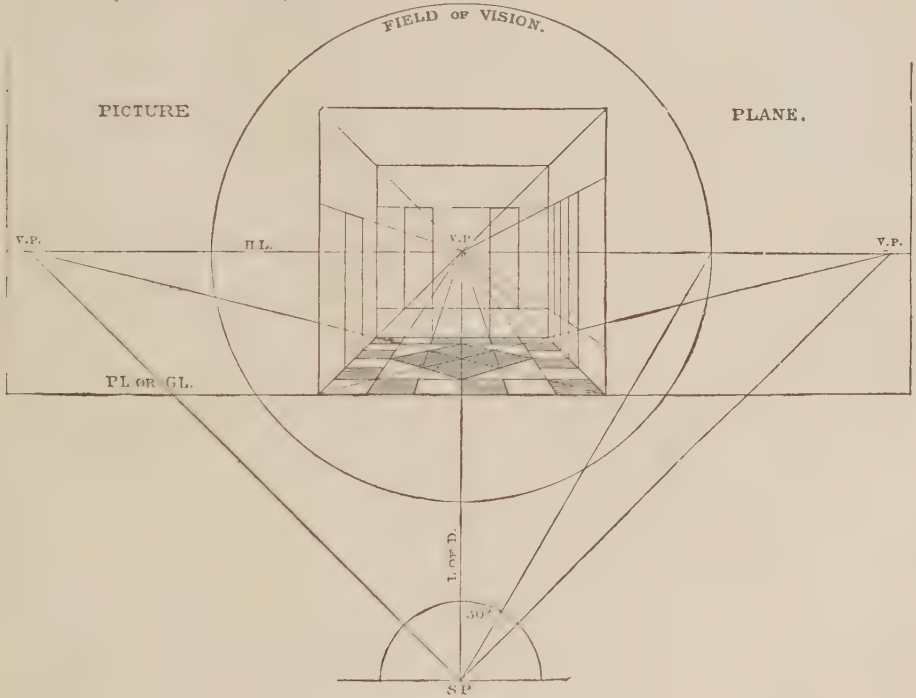


Fig. 2.

The L. of D. indicates the direction in which the spectator is looking. Its proportionate length is according to the distance of the spectator from the P. P. The Picture

Line (P. L.), or Ground Line (G. L.), is the lower edge of the P. P. The Field of Vision embraces what the eye, when fixed in one position, sees within a visual angle of about 60°. Vanishing Points are points to which parallel lines or edges, retreating from the eye, appear to converge.

All lines which, in the object or scene to be represented in perspective, are at right angles to the P. P., vanish in the C. of V. All lines parallel in the object and at angles other than 90° to the P. P. converge to or vanish in Vanishing Points at the left and right of the C. V. Measuring Points (M. P.) are points upon the P. P. by use of which apparent or perspective distances are measured. See Fig. 5.

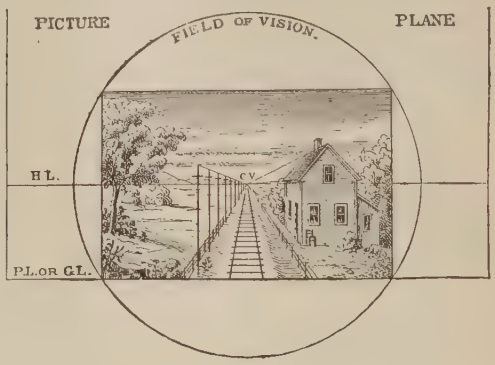


Fig. 3.

Convergence of lines, the apparent decrease in length of equal lines according to distance, and the increased foreshortening of distances as they retreat or recede from the eye, can be readily illustrated by a railroad track.

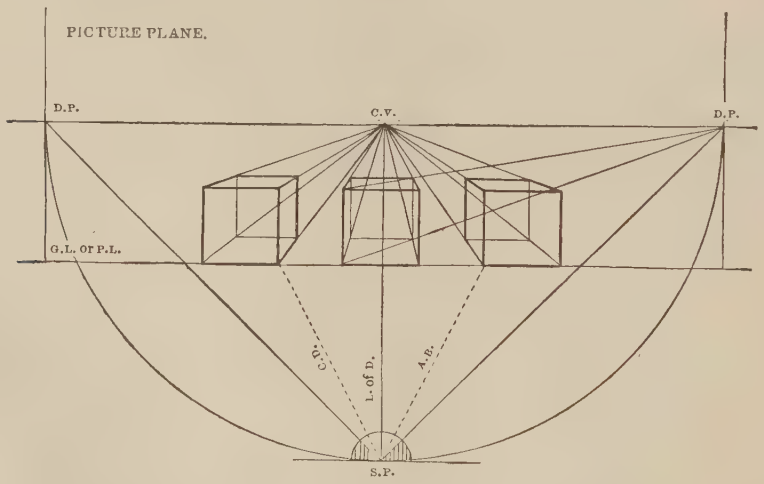


Fig. 4.

Theoretic perspective embraces parallel perspective, angular perspective, and oblique perspective. In parallel perspective, the object *stands* parallel to the Picture Plane.

Figs. 2, 3, 4: in angular perspective, the object *stands* at an angle (other than 90°) to the Picture Plane. Fig. 5; in oblique perspective, the object rests on one of its edges or corners, so that in the case of a rectangular object all of its faces are oblique to the picture plane.

Parallel perspective is little used in present instruction, as it gives so many distorted effects. It is not countenanced by good artists, except under special conditions of relationship of objects. The illustration, Fig. 4, shows a row of three cubes in parallel perspective: the one in the middle is a representation of the appearance of a cube in front of and below the eye: those at either side can be called approximately correct, only when considered in relationship to the middle cube or to each other. If a cube should be placed *alone* at the left or right of the eye, it would, according to *parallel perspective*, be drawn as in the illustration. Theoretically this is correct, because based on the supposition that the picture plane is fixed; but in model and object drawing, this is

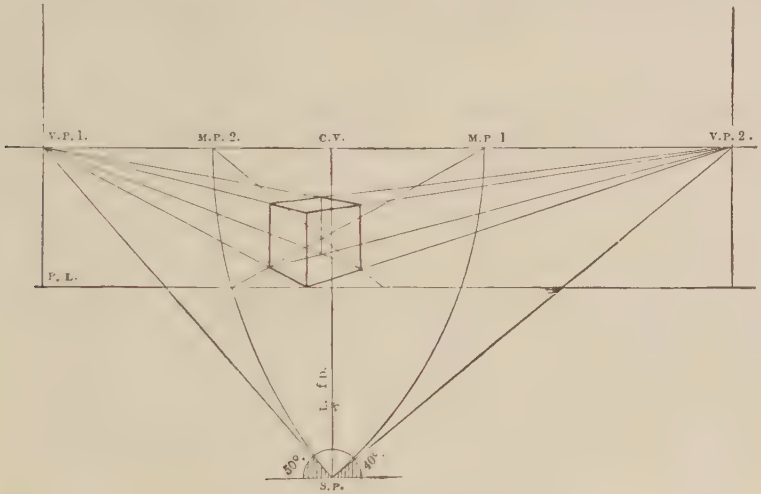


Fig. 5.

wrong. For in model and object drawing, the conditions of theoretic perspective, that the eye and the Picture Plane are arbitrarily fixed when a single object or several unrelated objects are to be drawn, cannot be accepted. In model drawing, when a cube or other object is observed *alone, at the left or right of the eye*, it becomes the direct object of observation; and the eye is directed towards it along a Line of Direction, AB or CD, decidedly different from the L. of D. shown in Fig. 4. The imaginary Picture Plane must always be at right angles to the Line of Direction; hence, whenever the Line of Direction is changed, the Picture Plane is also changed. Consequently, when a cube at

the left or right of the eye is observed alone, the Picture Plane is in quite a different position with relation to the cube from that assumed in the first instance, as shown in Fig. 4. The cube observed alone appears in angular perspective; the drawing will follow the general rules of angular perspective, as illustrated in Fig. 5.

From a lack of understanding of this change of the picture plane, many mistakes are made in illustrations in books and newspapers, by draughtsmen, who know only the rules and diagrams of parallel perspective. A *facsimile* of such an illustration is given in Fig. 6. These illustrations are, of course, broadcast, and the people have become familiarized with the error and accept it as truth. Unfortunately it has crept into school text-books also, and the pupils are constantly receiving false impressions. It is especially necessary, therefore, that teachers should have the truth clearly in mind and should confirm the statements in the preceding paragraph by their own observations of the appearance of single objects.

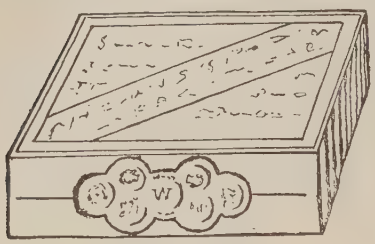


Fig. 6.

Incorrect Drawing.

Those teachers who are interested to look farther into the matter of theoretic perspective will find general statements, explanation of terms, illustrations, illustrative diagrams, and exercises in Drawing-Books Nos. 13 and 14 of the American Text-Books of Art Education, published by The Prang Educational Company, 1879.

The most exhaustive modern book on the subject is *Modern Perspective*, by Prof. William R. Ware, of Columbia College, published by Ticknor & Co., Boston.

There is an interesting book called *The Essentials of Perspective*, by L. W. Miller, principal of the School of Industrial Art of the Pennsylvania Museum, Philadelphia, in which the subject is treated in a familiar, conversational way, with attractive pictorial illustrations, published by Charles Scribner's Sons, New York, 1887.

A thoughtful contribution to the consideration of this subject will be found in *Free-Hand Drawing, Light and Shade*, and *Free-Hand Perspective*, by Anson K. Cross, Instructor in the Massachusetts Normal Art School, and in the School of Drawing and Painting, Museum of Fine Arts, Boston, published by the author, 1892.

2. ORTHOGRAPHIC PROJECTION.

Planes of Projection.—Projection of Solids, Surfaces, Lines, Points.

A brief statement is made here of the fundamental principles of orthographic projection, which is spoken of on page 38 as the school method. It is not thought *desirable to teach this method*; the explanation of the method is given here that teachers may have some idea of what is meant by orthographic projection.

For the purpose of representing the facts of solids, in their length, breadth, and thick-

GLOSSARY OF TERMS.

A.

Above the eye: situated in a plane higher than the level of the eye. In placing objects for pictorial drawing, it is desirable to place them but slightly above the eye.

Acute angle: see **Angle**.

Acute-angled Triangle: see **Triangle**.

Æsthetics: the theory of the Fine Arts; the science of the beautiful, and that branch of philosophy that deals with its principles; the doctrines of taste.

Alhambra: a memorable palace and fortress built by the Moors, near Granada, in Spain, in the fourteenth century.

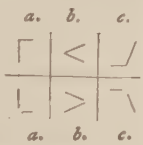
Alternate: placed by turns.

Altitude: height.

— of a curve: the greatest distance between a curve and its base, measured by a perpendicular to the base.

— of a solid or figure: the height of the solid or figure; it is the shortest distance from the highest point of the solid or figure to the plane of its base or lowest point.

Angle: the difference in direction between two or more faces, edges or lines, which meet or would meet, if produced.



—, Acute: an angle less than a right angle, as *b*, *b*.

—, Obtuse: an angle greater than a right angle, as *c*, *c*.

—, Right: an angle of 90° (see **Degree**), as the corner of the square or oblong, as *a*, *a*; an angle formed by two faces, edges, or lines perpendicular to each other. These lines may be either horizontal and vertical, or oblique.

Apex: the part of the blade of a leaf opposite the leaf stalk.

Appearance: the aspect of that portion of an object visible to the observer at any one time. The appearance of an object varies with its position and its location in relation to the observer, and with its distance from him.

Arabic ornament: see **Ornament**.

Arc: any portion of the circumference of a circle or other curve, as the curve *a b*.

Archimedean spiral: see **Spiral**.

Arrangement: the careful placing of models, objects or figures, with reference to others.

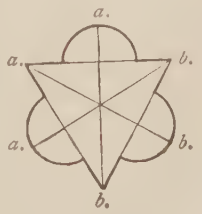
Art education: the development and cultivation of the æsthetic sense, that the individual may know how to see and appreciate the beautiful in nature and in art, and may promote its existence in art and manufacture, as far as possible.

Artistic rendering: see **Rendering**.

Axis of a solid: an imaginary straight line passing through its centre, and upon which it is assumed to revolve.

— of a figure: a straight line, real or imaginary, passing through the centre of a figure and terminating at its perimeter, and dividing it into two equal parts.

— of symmetry: a straight line, real or imaginary, that divides a figure into two equal parts, corresponding to each other in shape and in position, with regard to the axis. The lines *a b* are axes of symmetry.



B.

Back view: see **Views.**

Balance: an equable distribution of parts.

Band: the strip or ribbon placed across the radiating parts of a unit to hold them together. See the illustrations **Fleur-de-lis, Motive of design, Gothic ornament.**

Base of a form or figure: the part upon which it is assumed to rest. The ends of a prism are called its bases, though obviously it can rest upon but one at a time.

— of a leaf: the part of the blade adjoining the leaf stalk.

— of a curve: a straight line connecting its extremities. See **Arc.**

Beauty: that quality of color and characteristic of expressed thought that appeals to man's æsthetic sense, and to a greater or lesser degree satisfies it. While personal ideas of beauty vary, certain qualities and characteristics have, from time immemorial, been admired as beautiful, and have thus come to be accepted as elements of beauty.

Below the eye: a term of Representation to express the placing of an object sufficiently below the eye to give a pleasing pictorial effect. See page 48.

Biface corner: see **Corner.**

Bilateral symmetry: see **Symmetry.**

Bisect: to divide into two equal parts.

Blocking-in lines: straight or slightly curved lines, indicating the general proportion and outline of a figure to be drawn.

Blue: one of the six leading colors of the spectrum; a pigmentary primary.

— green: a color about half way between blue and green.

Blue violet: a color about half way between blue and violet.

Blunt corner: see **Corner.**

Border: repetition of a unit or portion of a design on a line.

Bottom view: see **Views.**

Breadth: the distance across from left to right.

Broken color: see **Color.**

Brown: a dulled color, composed of a mixture of red, blue, and yellow.

Busy work: simple tasks that may be given to a class, or a portion of a class, to keep them profitably occupied when not receiving direct instruction from the teacher. (See Prang's Primary Manual without Clay Modeling.)

Byzantine ornament: see **Ornament.**

C.

Calyx: the part of a flower below the corolla, usually green in color.

Carmine: a red, tending slightly toward violet.

Celtic ornament: see **Ornament.**

Central figure: see **Figure.**

Centre line: see **Line.**

Character of line: the width, color, and quality of lines varied to express varying conditions of light and shade, distance and distinctness.

Circle: a plane figure bounded by an evenly-curved line called its circumference.

Circular: having the shape of a circle.

— curve: see **Curve.**

— face: see **Face.**

— plinth: see **Plinth.**

— tablet: see **Tablet.**

Circumference: the line bounding a circle. It is so curved that every point is equally distant from a point within the circle called its centre.

Citrine: a color known as broken or dulled yellow, formed by mixing orange and green pigments; it is also called the yellow tertiary.

Color: objectively, that quality of a thing or appearance which is perceived by the eye alone, independently of the form of the thing; subjectively, a sensation, or the class of sensations, peculiar to the organ of vision, and arising from stimulation of the optic nerve. — *Century Dictionary.*

— **expression**: the expression of thought or of ideas of color, by means of colored pigments or materials.

— **perception**: the recognition of sensations produced upon the eye by different colors.

— **sense**: the sense through which the brain is made conscious of the various hues produced by the varying decomposition of light.

— **type**: the special tone of a color that is generally accepted as representative of that color. The solar spectrum, nature, and art, together establish color-types.

— **values**: the relative power of different colors with regard to their effect upon the eye.

—, **Contrasts of**: the difference between two or more hues.

—, **Leading**: those colors of the spectrum that in hue are most readily distinguished from all other colors. They are red, orange, yellow, green, blue, violet.

—, **Normal**: that tone of a color which most closely resembles its prototype in the solar spectrum.

—, **Pigment**: a color produced by use of mediums such as water-color, oil paints, etc.

—, **Primary**: a color of the spectrum that is considered as an element which, by combination with another primary, forms another spectrum color. Authorities vary in naming these colors. They are variously named, — as red, green, and violet in light, and as yellow, red, and blue in pigments.

—, **Scale of**: the regular transition from a color through succeeding modifications of it.

Color, Scale of: *Bichrome*: a scale that shows graded transition from one color to another, as the scale of colors from red to orange.

— *Dulled*: a scale of color modified by the addition of gray or brown.

— *Monochrome*: a scale of the various tones of one color, as from the lightest tint of blue through all the intermediate tones to the darkest shade of blue.

— *Polychrome*: a scale showing several colors in graded transition. The spectrum is a polychrome scale.

—, **Secondary**: a color produced by the mixture of two primary colors. The secondary pigment colors are orange, green, and violet.

—, **Spectrum**: a color found in the solar spectrum, *q. v.* There are six leading spectrum colors, — red, orange, yellow, green, blue, violet.

—, **Standard**: a color that is accepted by artists and scientists as a type of the color named.

—, **Tertiary**: a color resulting from mixing two secondary pigment colors. The tertiaries are citrine, russet, and olive.

Combination: the association of models for study with reference to their facts.

Composition: pictorial design; choice, and arrangement of objects for the purpose of representing them pictorially, with special reference to beauty of effect.

Cone: a solid having one plane circular face called the base and one curved face. The circumference of the curved face diminishes regularly until it vanishes in a point called the vertex. In a right cone the vertex is directly over the centre of the base.

Conic: having the leading characteristics of a cone.

Conic section: a section of a cone; in Fig. 1, the cone is represented as being cut parallel to its axis; in Fig. 2, as being cut obliquely to its axis.

Fig. 1.

Fig. 2.

Construction: one of the three subject divisions of drawing. The science and art of making diagrams or working-drawings which give the facts of objects, and from which objects may be constructed.

— line: see **Line**.

Constructive design: the planning for the construction of an object, giving due consideration to the pleasing arrangement and proportion of its parts and to the purpose it is to serve.

Continuous curve: see **Curves**.

Contrasts of color: see **Color**.

Conventions: arbitrary forms of procedure or expression authorized by the best custom, and accepted as having definite interpretation.

Conventionalization: the art expression of the inherent perfect type of a natural form as the result of overlooking or suppressing the accidents of individual growth.

Convergence: a coming together; in this work applied to the appearance of parallel horizontal edges that retreat from the observer, and are represented by converging lines.

Copies: drawings placed before a student for study and reproduction. They should be selected with great care as to subject and rendering.

Corolla: a little crown; the name of the inner set of leaves of a flower.

Corner: the space or contents included (within a short radius of the point of union) between faces, edges, or lines that meet.

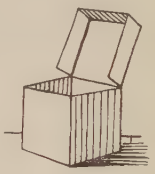


Fig. 1.

—, Biface: one formed by the meeting of two faces, as the vertical corner of a room.

—, Blunt: one in which the angle of meeting is greater than a right angle, Fig. 2, *a*.

—, Face: one formed by the meeting of two edges or lines, as the corners on *one face* of the box, Fig. 1.

Fig. 2.

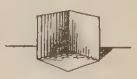


Fig. 3.

—, Inside: the corners, within a hollow form, Figs. 1 and 3.

—, Outside: the external corners of an object, Fig. 4.

—, Sharp: one in which the angle of meeting is less than a right angle, Fig. 2, *b*.

—, Solid: one formed by the meeting of faces.

Corner, Square: one in which the angle of meeting is a right angle, Fig. 2, *c*.

Fig. 4.

Fig. 5.

—, **Triface:** one formed by the meeting of three faces, Figs. 1, 3, 4, and 5.

Crenate: having the margin scalloped.

Cross: a form much used in art in all ages, but which since the Christian era is generally regarded as the symbol of Christian art. It is formed of two parts that cross each other.

Fig. 1.

Fig. 2.

Fig. 3.

—, **Greek:** one in which the four arms are equal and square, Fig. 1.

—, **Latin:** one in which the lower arm (called the shaft) is longer than the others, Fig. 2.

—, **Maltese:** one with equal arms that widen from the centre outwards, Fig. 3; Fig. 6 is an eight-pointed Maltese cross.

Fig. 4.

Fig. 5.

Fig. 6.

—, **St. Andrew's:** one in which the arms are oblique, Fig. 5.

—, **St. Anthony's:** one having but three arms, Fig. 4.

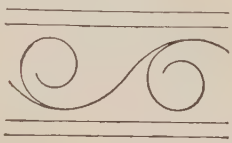
Cube: a solid having six equal plane square faces, the opposite faces being parallel.

Curvature: the degree of variation from straightness of a face, edge, or line.

Curve: a continuous bending.

—, **Circular:** an arc of a circle, *q. v.*

—, **Continuous:** a curve carried out without a break. The illustration shows continuous, reversed, and spiral curves.



—, **Elliptic:** an arc of an ellipse.

—, **Ovoid:** an arc of an oval.

—, **Reversed:** a curve that is reversed one or more times, bending first one way, then the other.

—, **Spiral:** a curve winding round a centre, and regularly receding from it.

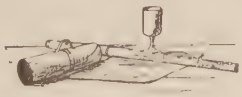
Curved edge: see **Edge.**

Curved face: see **Face.**

Curved line: see **Line.**

Cylinder: a solid having two equal plane circular parallel faces, and one curved face.

Cylindric forms: objects having the general form of a cylinder.



D.

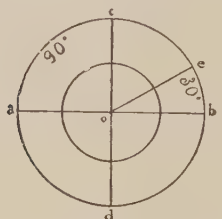
Dash lines: see **Line.**

Decoration: one of the three great divisions of the subject of drawing; the science and art of producing beauty in ornament.

Decorative design: the thoughtful production of ornament, that it may be adapted to the form it is intended to beautify, and may so fulfil its purpose.

Decorative figures: see **Figure**.

Degrees: the parts into which the circumference of a circle is divided for purposes of measurement. The number 360 has been chosen, as it is the multiple of so many



numbers that but few fractions occur in actual calculations.

Dentate: having a sharply-indented margin.

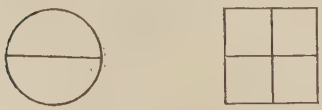
Details: the minor facts of form.

Development of surface: see **Surface**.

Diagonal: a real or imaginary straight line connecting angles of a figure that are not

adjacent. The illustrations show the diagonals of a square and an oblong.

Diameter: a real or imaginary straight line passing through the centre of a figure, terminating in its boundary, and dividing



it into two equal and corresponding parts. The diameter of a straight-line figure connects the centres of opposite sides.

Diaper: a design for covering a surface evenly. It is often based on the triangle or square.

Dimensions: the measurements of an object.

Direction: the tendency of a face, edge, or line from point to point.

Distance: the space between one point and another.

Dog-tooth ornament: see **Ornament**.

Drawing: the expression, with brush, pen, or pencil, of ideas of form.

Drill exercises: those given for the purpose of giving the pupils additional command of arm and pencil.

Dulled scale: see **Color**, *Scale of*.

E.

Edge: the place where two faces meet.

—, **Curved**: one whose direction constantly changes, as the edge of a hemisphere.

—, **Horizontal**: one whose direction is perfectly level.

—, **Receding**: one extending away from the observer.

—, **Straight**: one whose direction remains the same throughout its length.

—, **Vertical**: one whose direction is perfectly straight up and down.

Edge view: see **Views**.

Egyptian ornament: see **Ornament**.

Egyptian sphinx: a remarkable monument in Egypt, having the body of an animal and the head of a woman.

Egyptian zigzag: a border made by the repetition of acute angles, occurring frequently in Egyptian ornament.

Ellipse: a plane figure having a regular curved outline and a long and short diameter. It is like a flattened circle; a plane figure bounded by a curve, every point of which is at the same combined distance from two points within called the foci.

Ellipsoid: a solid bounded by one regularly rounding face and having three axes, two of which may be equal; a solid generated by the revolution of an ellipse on one of its axes.

Elliptical face: see **Face**.

Enclosing figure: see **Figure**.

End view: see **Views**.

Enlargement: the reproduction of a form or figure, making it of increased dimensions, but maintaining the proportions.

Equilateral triangle: see **Triangle**.

Equilateral triangular prism: see **Prism**.

Expression: the materialization of thought.

Extension: that property of a body by which it occupies a portion of space.

F.

Face: a part of a surface unbroken by an edge.

—, **Circular**: a face shaped like a circle.

—, **Curved**: a face that is straight one way and round the other, as one face of the cylinder or cone, Figs. 1 and 2.

Fig. 1.

Fig. 2.

Fig. 3.

—, **Elliptic**: a plane face having the shape of an ellipse; a tray often has an elliptic face.

—, **Horizontal**: one that is perfectly level.

Face, Oval: a plane face having the shape of an oval.

—, **Plane**: one having the same direction throughout; a perfectly even face, as though made by a carpenter's plane, Fig. 3.

—, **Round**: one that is equally round in every direction, as the face of the sphere, Fig. 4.

—, **Rounding**: one that is unequally or partially round, as the face of the ellipsoid, Fig. 5, or the rounding face of a hemisphere, Fig. 6; any modification of a round face.

Fig. 4.

Fig. 5.

Fig. 6.

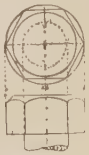
—, **Vertical**: one whose direction is straight up and down.

Face corner: see **Corner**.

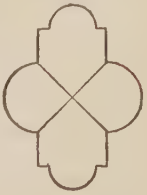
Face view: see **Views**.

Facing: having the whole of one face directly toward the plane of the observer.

Facts of form: the truths of form — that is, the actual shape, size, and proportion of a form; these are shown in working drawings.



Field of a unit: the space of the background to be filled by a unit. The illustration shows the four fields in an oblong quatrefoil.



Field lines: lines determining the field of a unit. See the oblique lines in the illustration.

Figure: that which has length and breadth, but no thickness.

—, **Central**: the figure used in a radiating design to hold the units together. Thus the circle is here the central figure.

—, **Decorative**: one whose beauty of outline and proportion warrants its use in decorative design.

—, **Enclosing**: the outline of the ground to be covered by a design. In the illustration a square is the enclosing figure.

—, **Geometric**: a figure readily classified among the plane figures of geometry.

Finishing: a term that embraces all that is necessary to the completion of a drawing that has been blocked in and sketched, *i. e.*, the erasure of construction and blocking-in lines, as well as of wrong or unnecessary lines, and the strengthening and accenting of lines already drawn, wherever this seems necessary to add expression or completeness to the work.

Flat pattern: see **Pattern.**

Flat washes: see **Wash.**

Fleur-de-lis: a beautiful decorative figure, supposed by some to have been derived from the flower of that name. It is found with many modifications, some of which are shown in the illustrations. It belongs to Gothic ornament.

Foreshortening: the decreased appearance of faces and edges that recede from the observer. The illustration shows the foreshortening evident in the upper face of a cylindric box placed below the eye.

Form: that which has dimension. Specifically, *form* is applied mainly where three dimensions exist, and *shape* or *figure* where but two dimensions exist. Form, however, includes *figure.*

Free movement: movement of the whole arm from the shoulder when drawing.

Fret: a continuous border made of lines at corresponding angles to each other.

—, **Greek**: a fret much used in Greek ornament. Fig. 1 shows the simplest form of the Greek fret, Fig. 2 the raking fret.

Fig. 1.

Fig. 2.

Front view: see **Views.**

Frustum: the part of a cone or pyramid remaining when the top has been cut off parallel to the base. Fig. 1 shows the front and top views and the development of the frustum of a cone.

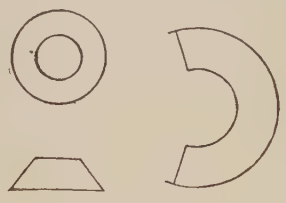


Fig. 1.

G.

Geometric ornament: see **Ornament.**

Geometric views: see **Views.**

Gothic ornament: see **Ornament.**

Grace: that beauty of form produced by delicacy and subtilty of outline and proportion.

Graded wash: see **Wash.**

Gray: a dulled color resulting from the mixture of black and white. It may also be produced by mixing green and red, blue and orange, etc.

Greek cross: see **Cross.**

Greek ornament: see **Ornament.**

Green: one of the six leading colors of the spectrum, in pigments called a secondary color, produced by the mixture of yellow and blue.

Ground: the space intended to be filled by a design; the space within the quatrefoil is the ground of this design.

Group: two or more objects placed in close relation to one another, but not in a row.

Growth: development of parts according to natural laws.

H.

Half-tinting: a series of parallel lines, equidistant from each other, by means of which an effect of color half way between black and white may be produced.

Harmony: the pleasing association of unlike elements. It is the mean point between monotony and discord.

Height: the vertical measurement of a form or figure.

Hemisphere: half a sphere; a form having one rounding face and one plane, circular face.

Hexagon: a figure having six straight sides; a regular hexagon is one whose sides are equal.

Hexagonal prism: see **Prism**.

Historic ornament: see **Ornament**.

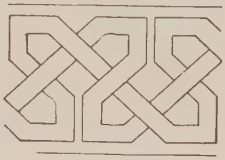
Horizontal: perfectly level. See **Edge**, **Face**, and **Line**.

Hue: the characteristic of a color that distinguishes it from any other color, as blue, red, etc.

I.

Inside corner: see **Corner**.

Interlacing: the passing of one part of a design alternately above and below another part. It is a characteristic of Saracenic ornament.



Invisible lines: see **Lines**.

Isosceles triangle: see **Triangle**.

Isosceles triangular prism: see **Prism**.

K.

Kite shape: a decorative figure having the shape of a kite. It is variously modified, and is much used in ornament.

L.

Latin cross: see **Cross**.

Leaf stalk: the small stem holding the blade of the leaf and uniting it to the main branch.

Length: dimension in only one direction, as of a line or edge.

Level of the eye: an imaginary horizontal plane on a level with the eyes of the observer. It is represented by a horizontal line called L. of E., the upper horizontal in the illustration.

Light and Shade: the result produced by representing in a drawing the effect of light, shade, and shadow.

Line: the representation of length, but not breadth or thickness.

—, **Centre:** one used to aid in placing drawings, indicating the centre of the figures drawn. In mechanical work it is usually made a long and short dash line. See illustration of dash lines. When a continuous line, it should be lighter than the rest of the drawing.

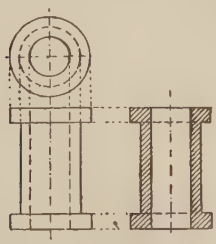
—, **Construction:** a line used as an aid in drawing other lines of a figure.

—, **Curved:** one whose direction constantly changes.

—, **Dash:** a line that is not continuous, but is made up of short strokes. The illustration shows the three kinds quite definitely.

— *Long:* This is used in working-drawings to express an invisible edge; each dash should be from ⅛″ to ¼″ in length.

— *Short:* The dashes in this should be less than ⅛″ in length. It is used for a working



line, *i. e.*, one that is to carry measurements from one view to another, also for dimension lines.

— *Short and Long:* This is a combination of the preceding. Care should be taken to have the difference in the length of the short and long lines used, quite marked. Centre lines are usually long and short dash lines.

Line, Dimension: a line upon which the dimensions of an object are marked in a working drawing. It may be a short dash line or a continuous line, broken at the centre for the figuring. ———4″———

—, **Horizontal:** a perfectly level line extending from left to right.

—, **Invisible:** a long dash line used to express an edge of an object that is not visible in the particular view being drawn.

—, **Oblique:** one that is neither horizontal nor vertical.

—, **Straight:** one whose direction remains the same throughout its length.

—, **Table:** a line in representative drawing used to express the surface upon which the objects drawn are resting.

—, **Transferring:** a line used to carry a dimension from one view to another. It may be either a short dash line or a light unbroken line.

—, **Vertical;** a line that is straight up and down.

—, **Visible:** a line representing an edge or outline apparent in the particular view being drawn.

—, **Working:** a line used to carry a dimension from one view to another; the same as a transferring line.

M.

Making: a concrete means of expressing ideas of form by means of modeling, paper cutting and folding, sewing, pasting, wood-cutting, etc.

Manual training: literally training of the hands. In its broader interpretation the training and general mental development induced by carefully directed exercises in making, drawing, and other hand work.

Margin: the uncovered space surrounding a drawing. It should always be sufficient to prevent the drawing from appearing to be crowded upon the sheet.

Fig. 1.

Marginal lines: lines used to limit a border, Figs. 1, 2, or a drawing.

Fig. 2.

Materials for ornament: see **Ornament.**

Measurement on pencil: the relative measurement of dimensions by observing the

distance they appear to cover on a pencil held at arm's length between the eye and the object.

Mediation: the assimilation of differences.

Mediæval: belonging to the middle ages, generally considered to be from the 10th to the 15th centuries.

Mental development: the harmonious cultivation of all the faculties and functions of the mind.

Method: the principles underlying a course of procedure.

Modeling: the production of a certain form by means of building it up or fashioning it of some plastic and easily-welded material, as clay.

Models: forms used for study for purposes of reproduction, either by making, modeling, or drawing. They should be chosen with care, and should be typical specimens in beauty and perfection of the forms they represent.

Modification of units: slight changes produced in a unit by altering its outline or proportion while maintaining the general character of its shape.

Moorish ornament: see **Ornament.**

Moors: a highly cultivated people living on the shores of the Mediterranean. They were dark-colored in complexion, and Mohammedans in religion. Their architecture and ornament rank among the leading Mediæval styles.

Motive of design: the basis of a design. Motive for design may be found in geometry, nature, or historic ornament. In the illustration, the sprig of maple leaves clearly furnished the motive for the design beside it.

N.

Natural forms: objects found in nature, as fruit vegetables, animals, etc.

Node: the part of a stem between one leaf and the next.

Normal color: see **Color.**

Norman zigzag: a border formed by the repetition of acute or right angles.

Number work: work in elementary arithmetic,

O.

Oblique line: see **Line.**

Oblique prism: see **Prism.**

Oblique to each other: faces, edges, or lines are oblique to each other when they are neither parallel nor perpendicular to each other. The lines in each illustration are oblique *to each other*, although in each illustration but one of the lines is oblique.

Oblong: a plane figure longer one way than the other, having four straight sides and four right angles. The opposite sides are equal and parallel.

Oblong: longer one way than the other.

Oblong quatrefoil: see **Quatrefoil.**

Obtuse angle: see **Angle.**

Obtuse-angled triangle: see **Triangle.**

Octagon: a figure having eight sides; a regular octagon has eight equal sides.

Olive: a color known as broken or dulled blue formed by mixing green and violet; it is also called the blue tertiary.

Orange: one of the six leading colors of the spectrum, in pigments called a secondary color, produced by the mixture of red and yellow.

—**green**: a mixture of orange and green, producing a color commonly called citrine.

—**violet**: a mixture of orange and violet, producing a color commonly called russet.

Ornament: that which is added to the essential features of form for the purpose of increasing its beauty. Ornament should be modest, consistent with the form decorated, and in harmony with the purposes to which it is to be applied.

—, **Arabic**: historic ornament in the style largely used by the Arabs, and later developing into the Moorish.

Ornament, Byzantine: a style of historic ornament, which attained its greatest development in Byzantium early in the Christian era. It was largely symbolic, and modified the Greek and Roman styles by engrafting upon them Christian symbols. See also **Cross, Quatrefoil.**

—, **Celtic**: Early British ornament, characterized by minute interlacing and elaboration of diagonal and spiral lines, and by grotesque animal forms, with an absence of plant form.

—, **Dog-tooth**: an ornament frequent in Romanesque architecture, supposed to resemble a dog's tooth. The illustration shows a top view of the ornament, which is somewhat like a low square pyramid. It was frequently used in mouldings.

—, **Egyptian**: ornament arising in Egypt, and one of the three leading ancient styles. It is symbolic and hieroglyphic rather than æsthetic. Symmetry is one of its leading characteristics. See also **Egyptian zigzag.**

—, **Geometric**: that which derives its motives mainly from geometry; such is Moorish ornament.

—, **Gothic**: a beautiful style of ornament that reached its greatest development in the twelfth and thirteenth centuries. It is one of the leading styles of mediæval ornament. See also **Fleur-de-lis.**

Ornament, Greek: one of the three leading ancient styles of ornament. It is highly æsthetic in character. See also **Greek fret**.

—, **Historic**: ornament that has been the art expression in decoration of peoples of past ages, and has thus become a part of their history.

—, **Materials for**: forms derived from geometry, nature or historic ornament suitable for use in decorative design.

—, **Moorish**: the highest form of Saracenic ornament, *q. v.*, as developed by the Moors.

—, **Renaissance**: ornament belonging to the Renaissance period, a leading style in modern ornament. This style had its birth in Italy in the fourteenth century. The name Renaissance is given to the period that witnessed a general revival of the classic styles, Greek and Roman, as well as to a specific development in this general revival.

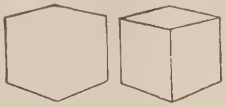
—, **Roman**: one of the three leading ancient styles of ornament. The acanthus, the scroll, and the rosette, with excessive ornamentation, are its leading characteristics.

—, **Romanesque**: a style of mediæval ornament which was a development of the Byzantine in combination with certain elements from the Roman and the Saracenic. See also **Norman zigzag**.

—, **Saracenic**: one of the leading styles of mediæval ornament. It includes the Arabian and the Moorish, *q. v.* It attained its most perfect expression in the Alhambra at Grenada. Its motive was geometric, as the Mohammedan religion forbade the reproduction of natural forms. See also **Interlacing**.

—, **Styles of**: divisions of historic ornament showing various marked and individual characteristics.

Outline: the defined limits of form. The outlines include not only the outline of the whole form, as at *a*, as seen in space, but the evident limits of parts of a form as distinguished from its other parts, as at *b*.



a. *b.*

Outside corner: see **Corner**.

Oval: a plane figure, longer one way than the other, bounded by curves that are symmetric as regards an axis. One end of this figure is larger than the other, Fig. 1.

Fig. 1.

Fig. 2.

Ovoid: a symmetric solid having one rounding face and having one end larger than the other, Fig. 2.

P.

Parallel: being of unvarying distance apart throughout their extent. Faces, edges, and lines may be parallel. A cube has three

sets of parallel faces and three sets of parallel edges. Parallel lines are here illustrated.

Pattern: anything cut, drawn, or formed, to be used as a guide in making an object, and serving to determine its exact form and dimensions.

Pattern, Flat: such a pattern as is used in the construction of articles made from textile fabrics, paper, sheet metal, or other thin material. The illustrations show the patterns of a cubic box and an envelope.

—, **Solid**: counterpart of a casting in wood or metal from which the mold in the sand is made.

Pentagon: a plane figure having five straight sides. A regular pentagon is one in which all the sides are equal.

Perception: that mental faculty through which the mind becomes cognizant of the impressions received through the senses.

Perpendicular: having directions at right angles to each other. Faces, edges, or lines are perpendicular to each other when they are at an angle of 90° to each other. Lines perpendicular to each other are here illustrated.

NOTE.—Perpendicular and vertical are not interchangeable. The former is a term of relation, and cannot be correctly applied to one face, edge, or line.

Petals: the separate parts of the corolla of a flower.

Petiole: the stem of a leaf connecting the blade with the main branch.

Pictorial drawing: representative drawing, *i. e.*, drawing which shows the appearance of objects, and which expresses this appearance with due regard to artistic effect.

Picture: a representation of objects by means of pencil, pen, or brush.

Pigment color: see **Color.**

Plan: the representation of a building or other structure in horizontal section.— *Century Dictionary.* A horizontal section at a given level.— *Knight's Mechanical Dictionary.*

Plane face: see **Face.**

Plant forms: any forms or shapes derived from vegetable life.

Plinth: a solid whose height is its least dimension.

—, **Circular**: a cylinder whose height is its least dimension.

—, **Square**: a square prism whose height is its least dimension.

Primary color: see **Color.**

Prism: a solid having two plane polygonal faces called bases, and between these as many plane side faces as the bases have sides. It may rest on either base.

Fig. 1.

—, **Hexagonal**: one whose bases are hexagons, Fig. 1.

—, **Oblique**: one whose axis is not perpendicular to its base, Fig. 2.

Fig. 2.

Fig 3.

—, **Right**: one whose axis is perpendicular to its base, Fig. 3.

—, **Square**: one whose bases are squares, Fig. 4. A cube is a square prism, whose side faces equal its bases in size and shape.

Fig. 4.

Fig. 5.

—, **Triangular**: one having triangles for bases, Fig. 5. A right-angled triangular prism has right-angled triangles for its bases. An equilateral triangular prism has equilateral triangles for its bases. An isosceles triangular prism has isosceles triangles for its bases.

Profile: the outline of a form as seen from one side; specifically, the limits of round, rounding, or curved faces.

Proportion: the relation of unequal parts.

Pyramid: a solid contained by a plane polygon as base and triangular planes meeting in a vertex. Pyramids are named from their bases, as triangular, square, etc., as the base is a triangle, square, etc.

Purple: a violet tending slightly toward red.

Q.

Quadrant: a quarter of a circle.

Quadrilaterals: figures having four sides. The oblong, square, rhombus, rhomboid, trapezium, and trapezoid, *q. v.*, are the various quadrilaterals.

Quadrisect: to divide into four equal parts.

Quatrefoil: a curvilinear figure of four leaf-like parts. It is much used in Christian art, and is there symbolic.

—, **Oblong**: one longer than it is wide.

R.

Radial designs: designs in which the units spread from a common point, as do the radii of a circle.

Radiation: spreading from a common centre.

Radii: plural of radius, *q. v.*

Radius: half a diameter of a circle; a line from the centre to the circumference of a circle. There are four radii in the illustration.

Receding edge: see **Edge.**

Rectangle: a figure, all of whose angles are right angles. A square and an oblong are rectangles.

Rectangular forms: those having rectangular faces.

Red: one of the six leading spectrum colors; a pigmentary primary color.

— **orange**: a color half way between red and orange.

— **violet**: a color half way between red and violet.

Renaissance ornament: see **Ornament.**

Rendering: the manner of expression in modeling, drawing, or painting.

—, **Artistic**: the pleasing interpretation of the spirit as well as the form of the objects studied, in modeling, drawing, or color.

Repeats: the units that are repeated in a design.

Repetition: one of the elements of design; the recurrence of one thing.

— **about a centre**: the symmetrical placing of repeats about a central figure.

— **in a straight line**: the regular placing of repeats in a row to form a border.

— **on an axis**: the recurrence of a shape, on the opposite side of a straight line, in such a way that the corresponding parts are in corresponding relation to the line, which is called an axis of symmetry.

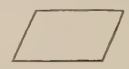
— **to cover a surface**: the recurrence of a figure, at regular intervals, in more than one direction.

Repose: an element of good pictorial composition and decorative design, which produces a restful effect.

Representation: one of the three subject divisions of drawing; the science and art of expressing on a plane surface the appearance of forms.

Reversed curve: see **Curve.**

Rhomboid: a quadrilateral which has its opposite sides equal and parallel, but none of its angles right angles.



Rhombus: a quadrilateral having four equal straight sides, and none of its angles right angles.

Rhythm: the effect produced by the regular repetition at pleasing intervals of the units of a decorative arrangement.

Right angle: see **Angle.**

Right-angled triangle: see **Triangle.**

Right-angled triangular prism: see **Prism.**

Right prism: see **Prism.**

Riser: the vertical part of a step in a flight of stairs.

Roman ornament: see **Ornament.**

Romanesque ornament: see **Ornament.**

Rosette: a decorative arrangement made by the regular repetition of units of design about a centre.

Round face: see **Face.**

Rounding face: see **Face.**

Row: an arrangement in a straight line.

Russet: a color known as broken or dulled red, produced by mixing orange and violet; it is also called the red tertiary.

S.

Scalene Triangle: see **Triangle.**

Scales of color: see **Color.**

Secant union: when a line joins another in such a way that if produced it would cross it, it is said to be a secant line, and the union is called secant.

Secondary color: see **Color.**

Sectional view: see **View.**

Semicircle: half of a circle.

Semidiameter: half of a diameter.

Shade: the darkness of an object on the side turned away from the light.

Shades: the tones of color darker than the normal tone.

Shadow: the darkness caused by one body intercepting part of the light falling upon another body.

Shape: that which has length and breadth, but no thickness.

Sharp corner: see **Corner.**

Side view: see **View.**

Simplicity: an essential of good ornament, resulting from the use of but few elements, and the judicious arrangement of these.

Size: that property of form by which it occupies space.

Sketches: hasty drawings made by way of taking notes.

Solid corner: see **Corner.**

Solid pattern: see **Pattern.**

Solar spectrum: the polychrome scale of color obtained by decomposing a ray of sunlight generally by means of a glass prism, or of a diffraction grating. The *normal* spectrum is produced by the grating.

Sphere: a solid having one round face — a ball.

Spheroid: a geometric solid, approaching a sphere, but not perfectly spheric; a solid, generated by the revolution of an ellipse on its axis.

Spheroid, Oblate: a solid generated by the revolution of an ellipse on its shorter axis; an oblate ellipsoid.

—, **Prolate**. a solid, generated by the revolution of an ellipse on its longer axis; a prolate ellipsoid.

Spiral: a curve winding around a fixed point. Each revolution of the curve is called a spire.

—, **Archimedean**: a name sometimes given to the equable spiral in honor of Archimedes, a celebrated Grecian mathematician, who first made known the mathematical principles of its construction.

—, **Equable**: one in which the distances between the successive spires are equal, Fig. 1.

Fig. 1.

Fig. 2.

—, **Variable**: one in which the distance between the spires increases with the distance from the centre, Fig. 2.

Spiral curve: see **Curve**.

Spire: one revolution of a spiral curve.

Square: a plane figure having four equal straight sides and four right angles.

— **corner**: see **Corner**.

— **leaved quatrefoil**: a name sometimes given to the Norman dog-tooth ornament, *q. v.*

— **plinth**: see **Plinth**.

— **prism**: see **Prism**.

Stability: an essential characteristic of good design, resulting from its strength and repose.

Standard color: see **Color**.

St. Andrew's cross: see **Cross**.

St. Anthony's cross: see **Cross**.

Stem: the stalk which supports the flower or fruit.

Stipules: small leaf-like appendages on the leaf-stalk, where it forms the main branch.

Straight: having but one direction; an edge or a line may be straight.

Styles of ornament: see **Ornament**.

Subordination: bearing such relation to other parts and to the whole as to lack prominence.

Surface: the whole outside of a form.

— **covering**: a decorative arrangement designed to cover a surface, usually formed by the repetition of units in two directions.

— **design**: a design for surface covering, *q. v.*

—, **Development of**: the pattern of the surface of an object.

Symbolism: the suggestion of a thought or series of ideas, by the use of forms that have naturally no direct connection with them. This was a leading characteristic of Egyptian and early Christian art.

Symmetry: the even disposition of similar and equal parts of a form or figure.

—, **bilateral**; the symmetry of two sides of a figure, usually applied to a figure having but one axis of symmetry.

T.

Table line: see **Line**.

Tablet: a piece of paper or card-board serving to express a shape. Its third dimension, thickness, is comparatively so slight that it is ignored, and for practical purposes, a tablet is assumed to have but two dimensions.

—, **Circular**: a tablet having the shape of a circle.

Tangential union: a union at one point only, as when a straight line touches the circumference of a circle.

Tertiary color: see **Color.**

Thickness: the least dimension of a solid; the third dimension of form.

Tint: the tones of a color lighter than the normal tone.

Title piece: the space marked off on the back of a book and reserved for the name of the book.

Tone: any state of a color as it passes from light to dark. Tones include tints, shades, and the normal tone.

Top view: see **View.**

Touch: one of the senses.

Trapezium: a plane figure having four straight sides, no two of which are parallel.

Trapezoid: a plane figure having four straight sides, two of which are parallel.

Transferring lines: see **Lines.**

Tread: the horizontal part of a step.

Trefoil: a triangular ornament with three leaf-like parts.

Triangle: a plane figure having three sides and three angles.

—, **Acute-angled**: a triangle all of whose angles are acute, Figs. 1, 2, and 5.

Fig. 1.

Fig. 2.

Fig. 3.

Triangle, Equilateral: a triangle whose three sides are equal, Fig. 1.

—, **Isosceles**: a triangle having two of its sides equal, Fig. 2.

—, **Obtuse-angled**: a triangle having one of its angles obtuse. See Fig. 6.

—, **Right-angled**: a triangle having one of its angles a right angle, Fig. 4.

Fig. 4.

Fig. 5.

Fig. 6.

—, **Scalene**: a triangle all of whose sides are unequal, Figs. 3, 5, and 6.

Triangular prism: see **Prism.**

Tri-face corner: see **Corner.**

Trisect: to divide into three equal parts.

Trisection: division into three equal parts.

Turned: placed so that no one face is directly toward the observer.

Type form: the perfect condition of a form.

U.

Unit: one.

— **of design**: the figure repeated in a decorative arrangement.

Unity: such a relation of the parts of a group or a decorative design as shows them to belong together.

V.

Variable spiral: see **Spiral.**

Variety: the result produced by the combination of unlike parts. It should always be subordinate to harmony.

Vase form: a solid made in semblance of a vase for purposes of study as to its proportion and curvature.

Veins: the small ribs of a leaf.

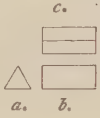
Venation: the arrangement and disposition of the veins of a leaf.

Vermilion: a red tending slightly toward orange.

Vertical: upright; straight up and down. A face, an edge, or a line may be vertical.

Vertex: that point of meeting of two or more edges, or of the vanishing of a curved face which is farthest from the base of a form or figure, as of a triangle or a cone.

View: drawings showing the facts of form. The illustration shows three views of an equi. tri. prism, the front, top, and left side or end views.



—, **Back**: the view obtained by looking squarely at the back of a form.

—, **Bottom**: the view obtained by looking at a form from a point directly below it.

—, **Edge**: the view of the edge of an object that has very little thickness, as a sheet of paper or a tablet.

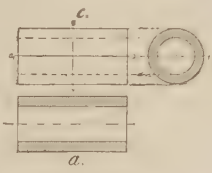
—, **End**: the view observed from a position opposite the end of an object. See illustration of **View**, *a*.

—, **Face**: the view of one face.

—, **Front**: the view obtained of an object when it is directly in front and opposite the eyes of the observer. See illustration of **View**, *b*.

—, **Geometric**: same as **View**.

—, **Sectional**: the geometric view of the interior of a form as it would be seen if cut through at some part. The parts cut are distinguished from the others in the drawing by half tinting, *i. e.*, lines drawn across it at regular intervals and at an angle of 45°; *a* and *b* are sectional views.



View, Side: the view obtained by looking at an object in a direction at right angles to that in which you looked for a front view, the various parts of the object being supposed to be on a level with the eye.

—, **Top**: the view obtained by looking directly down upon a form. See illustration of **View**, *c*.

Violet: one of the six leading colors of the spectrum; in pigment called a secondary color; produced by the mixture of red and blue.

Visible lines: see **Line**.

W.

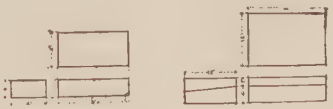
Wash: a thin coat of color spread over a space.

—, **Flat**: a wash of color, perfectly even throughout.

—, **Graded**: a wash of color that passes from a dark to a light tone in even gradation.

Width: the distance through from left to right, or from back to front.

Working drawings: drawings made as guides to the workman in the construction of an object. They show all the facts of form and size of an object.



Working lines: see **Line**.

Y.

Yellow: one of the six leading spectrum colors; a pigmentary primary.

— **green**: a color half way between green and yellow.

— **orange**: a color half way between orange and yellow.

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